

The Wildside Compilation:

Environmental Education Outreach



Written Contributions by:

Laura Burkholder, Megan Cook, Jessie Coty, Jennifer Garrison, Kelly Heidecker, Karen Jensen, Lisa Paterson, Brian Spirov, Michael van Hattem, Jim Woollett

Layout and Editing Contributions by:

Brett Clark, Don Johnston, Julie Korhummel, Anne Stark

Table of Articles

| Natural Resource | Article Title | Page |
|----------------------------------|--|------|
| Alameda Whipsnake | <i>Whipsnake finds home on the range at Site 300</i> | 4 |
| Bats | <i>Those bug-eating connoisseurs are a bit batty</i> | 5 |
| Burrowing Owl | <i>Out of sight burrowing owls hole up at Site 300</i> | 6 |
| California Legless Lizard | <i>When a legless, slithering reptile isn't a snake: California legless lizard</i> | 7 |
| California Red-legged Frog | <i>Survival strategies of the California red-legged frog</i> | 8 |
| | <i>Protecting the native frog</i> | 9 |
| | <i>Plight of red-legged frog illustrates problem of exotic species</i> | 10 |
| | <i>Red-legged frog at home in Lab and Site 300 habitats</i> | 11 |
| | <i>Survival strategies of the California red-legged frog</i> | 12 |
| California Tiger Salamander | <i>Tiger salamander is a truly unique California native</i> | 13 |
| Canada Goose | <i>Geese flocking to inviting urban landscapes</i> | 14 |
| | <i>Striving for balance where rural and urban meet</i> | 15 |
| Coast Horned Lizard | <i>Some like it hot: A look at the coast horned lizard</i> | 16 |
| Coastal sage scrub Community | <i>Live-trapping reptiles in the coastal sage scrub community, Site 300</i> | 17 |
| Cultural Resources | <i>A day in the life of a Lab archaeologist</i> | 18 |
| Diamond-petaled California poppy | <i>Believed extinct, rare jewel blooms at Site 300</i> | 19 |
| Dragonfly | <i>Basin aerial acrobats: Dragonflies and damselflies</i> | 20 |
| Fire Management | <i>Fire ecology has been a burning issue through the ages</i> | 21 |
| Golden eagle | <i>Local effort to protect majestic golden eagle takes wing</i> | 22 |
| Grassland Community | <i>Native California grasslands transformed over time</i> | 23 |
| Invertebrates | <i>Dr. Jekyll and Mrs. Hyde: Life of the tarantula wasp</i> | 24 |
| Large-flowered Fiddleneck | <i>Effort to restore endangered fiddleneck blossoms</i> | 25 |
| Loggerhead shrike | <i>Shrike's small size at loggerheads with killer reputation</i> | 26 |
| Migratory birds | <i>Birds of a feather flock to local sites for the winter</i> | 27 |
| | <i>Birding 101: Winging it in the Bay Area</i> | 28 |
| | <i>Tropical migrants return to Bay Area breeding grounds</i> | 29 |

| Natural Resource | Article Title | Page |
|-----------------------------------|---|-------------|
| Mammals (small) | <i>Small mammals are ecological giants in local grasslands</i> | 30 |
| Mountain lion | <i>Mountain lions are part of Tri-Valley environment</i> | 31 |
| Oak Woodland Community | <i>Majestic oak has deep roots throughout the Valley</i> | 32 |
| Rare Plants | <i>Site 300 annual spring photo safari</i> | 33 |
| | <i>Site 300's autumnal splendor</i> | 34 |
| | <i>Site 300 is an oasis for a rare native plant</i> | 35 |
| Rattlesnake | <i>There's no reason to get rattled as snake season starts</i> | 36 |
| Raven | <i>Ravens: Pondering a dark and mysterious bird of lore</i> | 37 |
| Red Fox | <i>Charismatic non-native fox highly adaptable outside of its range</i> | 38 |
| San Joaquin Kit Fox | <i>The San Joaquin kit fox: Where are they?</i> | 39 |
| Tri-colored Blackbird | <i>Tricolored blackbird wings it at Lab's Site 300</i> | 40 |
| Valley Elderberry Longhorn Beetle | <i>The secret life of the Valley Elderberry longhorn beetle</i> | 41 |
| Vegetation Communities | <i>New life sprouting at Site 300 after the 2005 Tesla fire</i> | 42 |
| Wetland Community | <i>Protecting arroyos vital to healthy area watershed</i> | 43 |
| | <i>The enhancement of a Site 300 wetland</i> | 44 |
| | <i>Vernal pools reflect seasonal changes</i> | 45 |
| | <i>Delving beneath the surface of the Laboratory's 'lake'</i> | 46 |
| Wild Turkey | <i>Going wild over turkeys is a November tradition</i> | 47 |
| Wildlife (General) | <i>Livermore site wildlife</i> | 48 |

Whipsnake finds home on the range at Site 300

The Alameda whipsnake is a lizard-eating connoisseur found on Site 300's south-facing slopes where rocky outcrops and sagebrush are warmed throughout the day.

The whipsnake is a snake found in only four counties of the United States (portions of Alameda, Contra Costa, Santa Clara and San Joaquin Counties) and it has highly specialized life habits (see below). Because the Alameda whipsnake (*Masticophis lateralis euryxanthus*) lives in one of the fastest-growing regions of California, it was studied by the U.S. Fish and Wildlife Service in the mid-1990s to determine if its population numbers were in decline.

Subsequently listed as a federally-threatened reptile in 1997, the whipsnake now receives national recognition as a special-status species under the Federal Endangered Species Act of 1973. Site 300 Management has been proactive in protecting the Alameda whipsnake onsite so that this unique species does not disappear from a portion of its range forever.

Snake's description

The Alameda whipsnake is a slender and speedy snake with a broad head, large eyes, and contrasting colors. Its cousin, the San Joaquin coachwhip (or "red racer"), is a reddish-colored snake that also has these characteristics and frequents Site 300 grasslands.

One of two subspecies of whipsnake in California, the Alameda whipsnake is distinguished from the more common chaparral whipsnake (*M. l. lateralis*) by a blackened back, a wide yellow-orange stripe that runs down its sides, and some light tan facial markings. The belly can appear a pinkish to red-orange coral color. Adults range in length from 3 to 5 feet. When captured, the whipsnake often lashes its body in spasms, imitating the motion of a bull whip, therein, a possible motive for the name "whipsnake".

Some whipsnakes, with partial or intergrade characteristics of the two subspecies exist, especially in the Corral Hollow Creek region of Site 300. The term intergrade describes an intermediate form of an animal. Intergradation in whipsnake populations is a natural and normal occurrence where Alameda and chaparral whipsnake ranges overlap or are adjacent to one another. The Endangered Species Act protects these intergrade forms of the whipsnake based on their genetic contribution to the species as a whole.

Snake's natural history

Alameda whipsnakes seem to have two peak times of the year for significant, seasonal movements. One is the spring mating season and the other is late summer or early fall (Sep-



Article and photos by Jim Woollett

tember). These whipsnakes generally find their winter shelter in November and sleep until about March of the following year. Home ranges of adult snakes can vary in size from 5 to 21.5 acres and can overlap with other whipsnake territories.

Whipsnakes have a specialized diet of lizard prey, but have been known to eat rattlesnakes given the opportunity. Both the chaparral and Alameda whipsnake are most often observed in sagebrush plant communities. This is the primary reason why the protected snake's numbers and geographic distribution are limited to very specific parts of the greater Bay Area. This scrub community is found in the inner coast range or Mt. Diablo range and vicinity. These habitats are more desert-like, with dry-sandy soils and patches of scrub supporting large numbers of lizards.

Site 300 has roughly 150 acres of this

patchy scrub that the snake can inhabit. Currently (and historically) the Livermore main-site has no known sagebrush.

Current threats to the Alameda whipsnake are habitat loss from urban development and impacts associated with increased human population densities. Fire suppression has also contributed to snakes losing habitat to decadent scrub "forests" across their range. Lastly, species isolation (even within the four adjacent counties previously mentioned) due to massive road/paving construction has led to population fragmentation of the snake.

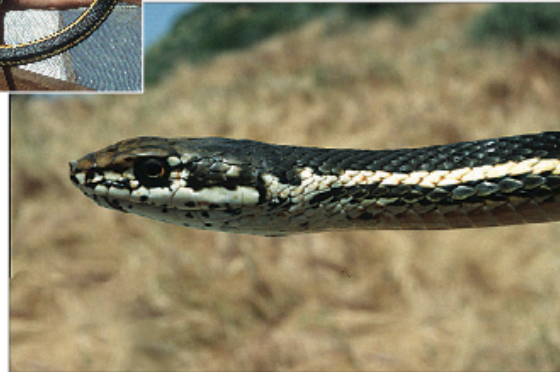
Snake's recovery

Recovery of the Alameda whipsnake and its removal from the protective regulations of the federal Endangered Species Act will rely upon special resource management factors such as habitat and fire management practices; control of destructive nonnative species; regional cooperation; and research that focuses on management objectives for the species. Little is known about which actions will provide the most benefit to the Alameda whipsnake's recovery, but it would appear that both long-term research and immediate active management decisions, such as the prescribed burns recently implemented at Site 300 are invaluable efforts to finding important resource-related answers.

Take a moment to identify the next snake you see and investigate whether or not it's an Alameda whipsnake. We're fortunate to live and work in the greater Bay Area where some of the rarest animal and plant life in the world can still be found. Now, how about some lunch...



The Alameda whipsnake can be found on Site 300's south-facing slopes where rocky outcrops and sagebrush are warmed throughout the day.



Those bug-eating connoisseurs are a bit batty

Although bats don't normally fit into the "good looks" category for mammals, their lack of exterior charm is compensated for by the vital role they play as bug-eating connoisseurs. A single bat may consume more than 3,000 insects in a night-time foray, thereby keeping our human world considerably more "bug-free." Multiply the number of bugs consumed by each bat by the 925 different species that exist worldwide and one starts to gain an idea of their ecological value on a landscape level.

Chiroptera, the scientific order for bats, means "winged hand" and this mystical title is apropos as many species of bat are barely understood and their natural history remains undocumented to date.

Twenty different bat species occur in California and each has its own unique life requirements and social organization. In the region surrounding LLNL, 15 kinds of bats are known to live, but the following 4 species are most likely to be encountered onsite (as they forage for dinner in the late evenings): Pallid Bat (*Antrozous pallidus*), Mexican Free-Tailed Bat (*Tadarida brasiliensis*), Hoary Bat (*Lasurus cinereus*), Western or Townsend's Big-Eared Bat (*Corynorhinus townsendii*).

The following sections highlight life history information for each of these species. Additionally, a recent acoustic survey for bat presence at Site 300 collected a sonic "signature call" for a Pallid Bat. Every bat species has a different signature call and these calls can be used to identify bat presence and use in an area.

Pallid Bat — State and federal special-status species

This bat is widely distributed in California and found in diverse habitats from sea level to above 2000 meters in the Sierras. Although encountered roosting in or around buildings, bridges and other man-made structures, in this area it is most associated with oak grassland habitats. These natural settings typically have a variety of caves, rock crevices and tree hollows for roosting. Colony size is typically comprised of 50-300 individuals. These bats often feed on large, ground-dwelling arthropods (e.g., scorpions, Jerusalem crickets).

Mexican Free-tailed Bat — No state or federal status

This is the most common bat in lowland areas of California. These bats roost in aggregations within crevices or cavities; they will also use human structures. Colonies are capable of being quite mobile and will utilize other roosts if disturbed or seasonally involved in interstitial movements. Most roosting colonies in California consist of several hundred to several thousand bats. They are not known to hibernate during the winter but undergo periods of torpor or brief inactivity



Western or Townsend's Big-eared Bat — State and federal special-status species

This is another broadly distributed bat species in California with records of presence ranging from the margins of the Central Valley to all elevations in the Coast Ranges and moderately high elevations in the Sierra Nevada. This species is an obligate cave-dweller that is largely reliant on the natural rock

caves and abandoned mines for maternity roosts and reproduction. It tends to hang on open surfaces and in clusters within cave systems. Shallow caves can be occupied if their heights are greater than 2 meters, which is important in avoiding discovery by snakes and other terrestrial predators.

Maternity colonies are normally between 25-300 individuals. Studies indicate that this bat feeds mostly on moths and forages along vegetated creek drainages and in proximal forested areas. Big-eared bat echolocation calls are of low intensity and are rarely detected by acoustic recorders away from roost sites.

Roost sites are crevices, cavities and foliage. Some species, like the foliage-roosting red bat, do not form large colonies; others like Mexican free-tailed and Yuma myotis form colonies from 100 to several thousand individuals. Natural features and human-built structures may serve as roost sites. Temporary aggregation sites are known to be used during spring and fall for migrating animals. Refuges for hibernating animals in the winter are extremely important for survival.

Bats may roost at night while consuming prey or joining larger aggregations of individuals (including other species). These sites need to offer protection from predators and thermal buffering against air temperature declines throughout the night.

All bat species are insectivorous. At night, bats concentrate over and near areas with perennial water. Movements of several kilometers one way to a foraging site have been recorded for radio-tagged bats. Daily waterloss may constitute 15-20 percent of their total body weight during the summer, drinking while flying over a water source is the typical method used to rehydrate.



Left: Close up of a Hoary Bat. Center: Mexican Free-Tailed Bat colony flying away from roost. Top right: Townsend Big-Eared Bat colony roost in a cave. Bottom right: Pallid Bat.

WILLIAM LEONARD

GLENN AND MARITHA VARGAS © CA ACADEMY OF SCIENCES

LLOYD JONES © CA ACADEMY OF SCIENCES

TOM GRIER

Out of sight burrowing owls hole up at Site 300

The western burrowing owl is a species adapted to grassland ecosystems. Grassland animals share characteristics that are uniquely derived from their habitat and differ from animals found in other habitats, like chaparral or forest environments. These characteristics help them survive the localized conditions of open plains and restricted resources.

One of the more noticeable and common traits of grassland fauna is the abundance of burrowing species. Ground squirrels and deer mice are well known fossorial animals, but many reptiles, some amphibians and even a bird — the burrowing owl — spend time underground in rodent burrows as well.

Burrowing owls prefer to live underground for several reasons. Typical grassland ecosystems provide little cover or places to hide from predators. Secondly, climatic variation may oscillate widely and underground life offers more constant and safer temperatures throughout the year. Lastly, a burrow represents a safe place or refuge from grassland fires that typically pass over burrows quickly and with lower temperatures than the woodland forest fires.

Burrowing owls presently live at Site 300, and as recently as 1997,



By Jim Woolett

have been seen nesting at the Livermore main site within the north buffer zone. The owl is about nine inches tall and is quite active in the daytime, contrary to other owl species. It hunts a variety of food sources, but usually relies upon mice during the winter and large-bodied insects (like the Jerusalem cricket) in the summer to forage

upon.

It occupies burrows previously excavated and abandoned by ground squirrels or badgers. These burrows are generally between three to six meters in length and end in an antechamber that serves as the nesting area for young. A productive nest may have five to eight owl nestlings visible in June at the burrow entrance. Much is known about the owl from studies performed during the breeding cycle when the birds are quite visible. But much less is known about its winter habits and localized or long distance migrations that may occur into and from this area of California.

Besides the dry, open grassland habitats, burrowing owls may be seen close to human habitations such as golf courses, airports, vacant lots in residential areas, right-of-ways and any place potential subterranean burrows are present. These flatland areas in the central valley and bay areas are also prime building locations and are rapidly becoming areas developed for human use.

The bird is now found only in a fraction of its historical range in California. At LLNL it receives protection through measures designed to safeguard active burrows of the local owl population. In the next decade, LLNL burrowing owls may be one of the few among the remaining populations in this region.



Left, a rodent burrow serves as home to the western burrowing owl. Above, a family of western burrowing owls peek out from their nest. Right, an adult steps out its burrow.

CIRIS ALDRETH/NASA

When a legless, slithering reptile isn't a snake: California Legless Lizard

By Jessie Coty



2007 William Flaxington (CalPhotos)

The California legless lizard looks more like a worm or a small snake, yet it's a burrowing (fossorial) lizard with very unique adaptations.

A lizard is a four-legged reptile that is covered in scales, right?

Not always. The California legless lizard (*Anniella pulchra*) turns that image upside-down, or more precisely, firmly to rest — on the ground without legs.

Pencil-sized and at risk

This small lizard is typically silver or beige on its back, with a yellow-white to bright yellow underside. A black line usually runs over the length of its back. Simply stated, it looks like a worm or small snake.

Observed just once at Site 300, this California Species of Special Concern exists here but is difficult to detect. This status identifies species at risk for becoming threatened or endangered.



2007 William Flaxington (CalPhotos)

The coloration of the California legless lizard varies including metallic silver, beige, dark brown and black (on its back).

Why isn't it a snake?

Snakes and lizards share a common evolutionary past, yet changes that occurred over the millennia resulted in their modern separation. Although key internal organ and skeletal differences exist, for most of us, an answer to this question merely involves an intimate reptilian encounter. If it blinks, it's not a snake. And, more dramatic than the lizards' moveable eyelids: if it slithers away yet drops (detaches) its tail to leave a predator behind, it's not a snake.

Adaptations set this lizard apart

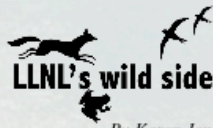
The highly unique life strategy of the legless lizard directly results from its evolutionary adaptations. Whether the legless lizard ever had legs or evolved to its present legless form remains a question. Yet, this adaptation, and many others, allow it to occupy an unusual, fossorial (burrowing) niche that is unexploited by other lizards. This gives it a life history that varies greatly from snakes.

Umbless and with smooth, polished scales, the legless lizard is known for stellar "sand-swimming" or burrowing easily through moist, sandy or loose soils. Other adaptations, like its "shovel-shaped" snout, counter-sunk jaw and blunt tail, aid these movements. Beneath the leaf litter, this lizard seeks food. Unlike snakes, its prey consists of insect larvae, termites, small adult insects, spiders and other invertebrates. No mice.

Spotting this elusive lizard takes a sharp eye and a bit of luck; but it's worth a try. It burrows in the sand washes, sand dunes, bases of slopes or near streams of its preferred habitats — sparsely vegetated beaches, chaparral, pine-oak woodland or streamside growth of sycamores, cottonwoods and oaks. The lizard is easier to find on cool days as it generally surfaces only in cooler weather (60-65 degrees Fahrenheit). Good luck.

SCIENCE NEWS

Survival strategies of the California red-legged frog



By Karen Jensen



An adult California red-legged frog.

PHOTO BY MICHAEL VAN HATTEN, EPD

The federally protected California red-legged frog (*Rana aurora draytonii*) can be found in streams, ponds, marshes and artificial water sources such as stock ponds. Here at the Laboratory, you might observe these crimson hued creatures at Lake Haussmann and Arroyo Las Positas, or in the wetlands of Elk Ravine and Gooseberry Canyon at Site 300.

Often these aquatic habitats available to frogs are isolated from each other by wide expanses of terrestrial habitat. These seemingly isolated frog populations are linked together to form a larger group referred to as a metapopulation.

The populations of frogs that make up the metapopulation operate independently of each other. However, during certain times of the year, some frogs will travel beyond their usual pond either to the surrounding terrestrial habitat in search of food or shelter, or to migrate to another aquatic habitat.

Throughout the summer months, California red-legged frogs often move into terrestrial areas to forage and seek shelter. During this period, frogs can be found under boulders or rocks and organic debris, such as downed trees or logs; industrial debris; and agricultural items like drains, troughs or sheds. Small burrows, like those made by ground squirrels, provide an important

safe haven from the intense summer heat. Moist leaf litter and narrow stream channels also allow the frogs to hunker down, waiting for the fall rains. Frogs will even use the deep cracks of drying ponds, anything that provides shade, cooler temperatures, and a bit of moisture.

During periods of wet weather, some frogs use the rain to travel overland and settle in new aquatic habitats. This usually begins with the first rains of the fall and most of these overland movements happen at night. Frogs can travel under these conditions for distances of more than 1.9 miles (3 kilometers) with no apparent regard to topography, vegetation type or riparian corridors.

Movements of individual frogs throughout the metapopulation allows for the exchange of individuals and recolonization in the event of a local extinction. Access to appropriate terrestrial habitat allows the frogs to survive throughout periods of drought and heat.

Biologists and resource managers are attempting to understand the survival strategies of the California red-legged frog. One thing is certain: the frogs, not only at LLNL's sites but throughout the region, have the greatest chance of survival when there are multiple areas of suitable aquatic habitat connected by suitable terrestrial habitat.



U.S. FISH AND WILDLIFE SERVICE.

Above: Aerial view of California red-legged frog breeding (aquatic) habitat surrounded by terrestrial habitat. Inset: An adult California red-legged frog wearing a radio-transmitter. This is a device that can help biologists study movement and habitat use within the metapopulation. Background image: This wetland at Elk Ravine is used by California red-legged frogs. CREDIT: COREY CATE

PHOTO BY
MICHAEL VAN HATTAM

Newsline
UC-LLNL
PO Box 808, L-797
Livermore, CA 94551-0808



Protecting the native frog

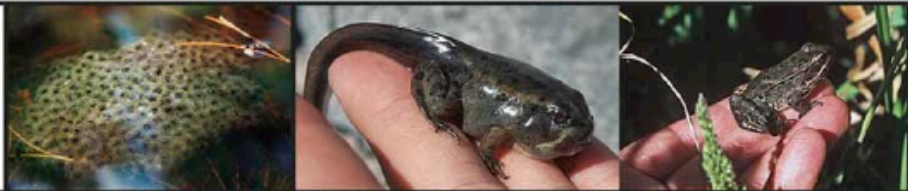
Text and photos by Michael G. van Hattem

The California red-legged frog (*Rana aurora draytonii*) was listed as "threatened" under the Federal Endangered Species Act (ESA) in 1996. At that time, the U.S. Fish and Wildlife Service had determined that the frog had been extirpated from 70 percent of its historic range from Redding, Calif. to Baja California, Mexico. The California red-legged frog, the largest native frog in California, is widely known for its vibrant coloration, as well as its jumping ability (Mark Twain's jumping frog of Calaveras County). California red-legged frog populations decreased markedly in the late 1800s when they were hunted for human consumption; subsequently habitat loss, and the introduction of non-native predators (i.e. bullfrogs and fish) have resulted in further population declines and isolation of remaining habitat. At LLNL, Environmental Protection Department wildlife biologists work to conserve and enhance California red-legged frog populations at the Livermore site and Site 300 while balancing the needs of LLNL projects and operations.

California red-legged frog life cycle

(Left to right)

- Egg mass (2,000 – 4,000 eggs)
- Metamorphic larva
- The California red-legged frog



Our largest native frog

(Left to right)

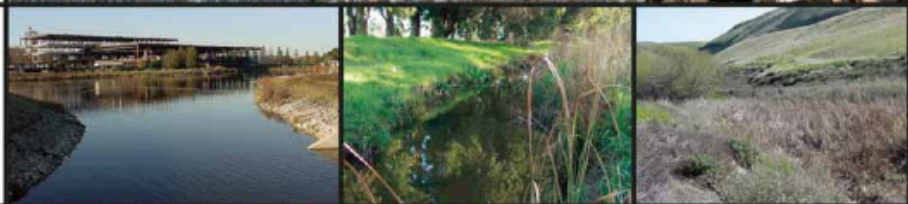
- Gravid female frog
- Front view of adult frog
- Adult frog being tracked by biologists (note radio transmitter belt) in the Arroyo Las Positas (Livermore site)



Livermore site and Site 300 habitat

(Left to right)

- Drainage Retention Basin
- Arroyo Las Positas
- Elk Ravine (Site 300)



Management

(Left to right)

- Biologists electrofishing the Drainage Retention Basin to remove non-native fish
- Biologist removing a bullfrog egg mass
- Silt fencing used to exclude frogs from a project area where they would be at risk



Plight of red-legged frog illustrates problem of exotic species

Remove a frog to save a frog? To some, eradicating one species to save another doesn't make any sense. Despite this irony, biologists commonly face this dilemma in their everyday effort to conserve biological diversity.

The intentional or unintentional release of animals and plants outside of their native habitat or geographical region into another region can have a dramatic, lasting and unforeseeable impact on native species and habitats. At a minimum the result may be competition for survival and predation. Much worse is the potential for population extirpation (i.e., localized extinction) and extinction. Furthermore, the issue of exotic species introductions and impact on native species and habitats goes way beyond the borders of any county, state or country; the issue at hand is a global phenomenon changing the species make-up of each and every country on the planet.

As stated, most exotic species invasions result in the displacement or replacement of native species. When coupled with other population pressures, such as habitat destruction and modification, climate change or pesticides, the synergistic effect has the potential to be catastrophic. Case in point is the California red-legged frog (*Rana aurora draytonii*). It is California's largest native frog and was once found from Redding, Calif. to Baja, Mexico, but is now extirpated from 70 percent of its historic range. Most California red-legged frog population declines can be attributed to habitat loss and modification. But now more than ever, the remaining population segments are threatened by the spread of species introduced from the southeastern United States such as bullfrogs (*Rana catesbeiana*) and Centrarchid fish (i.e., bass, bluegill, etc.). In other words, habitat loss and exotic species invasion are recognized as the proverbial one-two punch leading to extinction.

LLNL's wildlife biologists are smack dab in the middle of this struggle, faced with exotic species at both the



By Michael G. van Hattem



California's biodiversity is world-renowned but is in jeopardy. The California red-legged frog has declined through much of its historic range and is protected under the U.S. Endangered Species Act. Predation by exotic species has greatly contributed to its decline.



MICHAEL G. VAN HATTEM

A grim ecological reality: the necropsy of a 2-year-old bullfrog revealed 10 native pacific treefrogs (*Hyla regilla*) in its stomach contents. This bullfrog was removed from the Drainage Retention Basin at the Livermore Site.



DAVID COOK, SONOMA COUNTY, CA

Bullfrogs prey upon all frog species. A large adult bullfrog that attempted to consume an adult California red-legged frog and suffocated on it as a result (note feet protruding from the bullfrog's mouth).



DAVID COOK, SONOMA COUNTY, CA

The adult California red-legged frog removed from the bullfrog at left. A ruler illustrates the size discrepancy between the two species.

Livermore Site and Site 300.

At the Livermore Site, the centrally located Drainage Retention Basin has unfortunately become a repository for numerous exotic species. The DRB has a range of management objectives (see previous DRB Wildside article), including managing the lake in ways beneficial to the California red-legged frog. Exotic fish have recently been released into the basin in large numbers by an unknown source resulting in a situation that biologists need to remedy. The federal Endangered Species Act (Act) and Executive Order 13112 call for federal agencies to further the purposes of the act by engaging in conservation actions (help recover endangered species) and by limiting the spread of exotic species that threaten biological diversity.

The seemingly innocuous act of relocating, releasing or introducing species outside of their historic range, has very significant, harmful ramifications (not to mention it's illegal without permits). The act of stocking the DRB with bass and bullfrogs dramatically affects the survival of (endangered) native species already in peril. It is our responsibility to help conserve the biological diversity of California for future generations. California's critters are at stake; extinction is final.

For more information on exotic species see the following Websites: <http://www.invasivespecies.gov/> or <http://tncweeds.ucdavis.edu/> or contact Michael van Hattem at 4-6795 for information about this article and LLNL's Invasive Species Program. View previous Wildside articles by this author and others at the LLNL Wildside Series Archives at <http://www-envirinfo.llnl.gov/>.

Red-legged frog at home in Lab and Site 300 habitats

Editor's note: This column inaugurates a new monthly feature by Laboratory wildlife biologists about wildlife at the Lab and Site 300.

California red-legged frogs may be found in most wetland habitats at the Laboratory and Site 300.

The California red-legged frog (*Rana aurora draytonii*) historically ranged from Marin County inland to Shasta County and southward to Northwest Baja California. Documented throughout 46 counties, the red-legged frog is now extinct in at least 24 of these, and as a result, received federal protection in 1996 as a "threatened species" under the Endangered Species Act.

Metamorphosis, an important milestone in its transformation from tadpole to frog, occurs in July and August. Egg masses (far left) of a few hundred to thousands eggs laid in February-March have spent the last several months developing through the risky tadpole period (second from left). The tadpole period is thought to be the stage of development in which the highest mortality occurs.

In July, metamorphosis (second from right) has begun; front and rear legs have formed and developed, and the tail, which has been so important for mobility over the last few aquatic months, is now being absorbed into the body. When the tail is completely absorbed the tadpole is considered a frog.



Article and photos by Michael G. van Hattem

As a native species, red-legged frogs have evolved and adapted to the Mediterranean climate of California, completing metamorphosis in early summer before wetlands dry out. To avoid the danger of drying out, red-legged frogs can disperse into upland habitats and seek refuge in California ground squirrel (*Spermophilus beecheyi*) burrows, riparian areas or other wetlands. Frogs have been documented moving up to two miles in just a few days.

The diet of the California red-legged frog is highly variable; as larvae, these frogs are thought to be algal grazers, and as they develop into frogs their diet shifts toward invertebrates and small vertebrates such as Pacific tree frogs (*Hyla regilla*) and California mice (*Peromyscus californicus*). Cali-

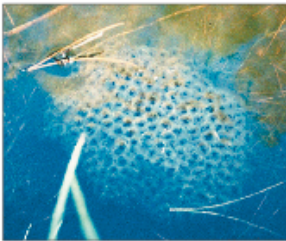
fornia red-legged frogs are California's largest native frog, attain sexual maturity at 2-3 years of age and may live 8-10 years, although the average life span is probably less.

A number of human influences threaten the survival of the California red-legged frog including loss of wetlands, use of pesticides and introduction of non-native species such as the bullfrog (*Rana catesbeiana*). Although threats to remaining populations vary geographically, introduced aquatic predators constitute the most significant threat to remaining populations within suitable habitat.

The U.S. Fish and Wildlife Service considers the Tri-Valley and surrounding foothills a "Key Area" for conservation because the California red-legged frogs can still be found in decent numbers compared with the rest of California.

Lab policy and federal law protect the California red-legged frog. You can help the California red-legged frog by avoiding impacts to wetland areas and not releasing any pets or other wildlife into ponds and streams. Contact the Environmental Protection Department's wildlife biologists if you encounter a frog at either of the sites.

For questions or additional information about this article, contact wildlife biologist Michael G. van Hattem at 4-6795.



Red-legged frog egg masses



Red-legged frog tadpole



Metamorphosis of tadpole to frog



Adult red-legged frog

SCIENCE NEWS

Survival strategies of the California red-legged frog



By Karen Jensen



An adult California red-legged frog.

PHOTO BY MICHAEL VAN HATTAM, EPD

The federally protected California red-legged frog (*Rana aurora draytonii*) can be found in streams, ponds, marshes and artificial water sources such as stock ponds. Here at the Laboratory, you might observe these crimson hued creatures at Lake Haussmann and Arroyo Las Positas, or in the wetlands of Elk Ravine and Gooseberry Canyon at Site 300.

Often these aquatic habitats available to frogs are isolated from each other by wide expanses of terrestrial habitat. These seemingly isolated frog populations are linked together to form a larger group referred to as a metapopulation.

The populations of frogs that make up the metapopulation operate independently of each other. However, during certain times of the year, some frogs will travel beyond their usual pond either to the surrounding terrestrial habitat in search of food or shelter, or to migrate to another aquatic habitat.

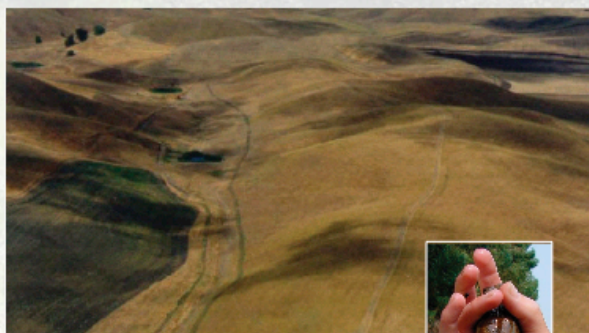
Throughout the summer months, California red-legged frogs often move into terrestrial areas to forage and seek shelter. During this period, frogs can be found under boulders or rocks and organic debris, such as downed trees or logs; industrial debris; and agricultural items like drains, troughs or sheds. Small burrows, like those made by ground squirrels, provide an important

safe haven from the intense summer heat. Moist leaf litter and narrow stream channels also allow the frogs to hunker down, waiting for the fall rains. Frogs will even use the deep cracks of drying ponds, anything that provides shade, cooler temperatures, and a bit of moisture.

During periods of wet weather, some frogs use the rain to travel overland and settle in new aquatic habitats. This usually begins with the first rains of the fall and most of these overland movements happen at night. Frogs can travel under these conditions for distances of more than 1.9 miles (3 kilometers) with no apparent regard to topography, vegetation type or riparian corridors.

Movements of individual frogs throughout the metapopulation allows for the exchange of individuals and recolonization in the event of a local extinction. Access to appropriate terrestrial habitat allows the frogs to survive throughout periods of drought and heat.

Biologists and resource managers are attempting to understand the survival strategies of the California red-legged frog. One thing is certain: the frogs, not only at LLNL's sites but throughout the region, have the greatest chance of survival when there are multiple areas of suitable aquatic habitat connected by suitable terrestrial habitat.



U.S. FISH AND WILDLIFE SERVICE.

Above: Aerial view of California red-legged frog breeding (aquatic) habitat surrounded by terrestrial habitat. Inset: An adult California red-legged frog wearing a radio-transmitter. This is a device that can help biologists study movement and habitat use within the metapopulation. Background image: This wetland at Elk Ravine is used by California red-legged frogs. CREDIT: COREY CATE

PHOTO BY
MICHAEL VAN HATTAM

Newsline
UC-LLNL
PO Box 808, L-797
Livermore, CA 94551-0808

Tiger salamander is a truly unique California native

It's hard to imagine a heat sensitive animal that can easily dry up and die from heat exposure living far from water in the grasslands of California. As we all know, the weather of the Tri-Valley and Central Valley of California is characterized by long periods of high temperatures, low humidity and periodic droughts followed by relatively brief, cold and wet winters.

Even with the prospect of desiccation, the California tiger salamander (*Ambystoma californiense*) has evolved to fill a niche occupied by no other salamander in California. The only way the California tiger salamander can persist in this seemingly inhospitable habitat is to hide from the relentless heat in the mild underground climate of tunnels and dens of grassland mammals. Grassland mammals have a propensity to dig elaborate burrows for breeding and shelter. The California tiger salamander is not anatomically equipped to dig its own burrow so instead takes advantage of the hard work of others. Of particular importance to the California tiger salamander in Livermore and Site 300 is the California ground squirrel (*Spermophilus beecheyi*) and to a lesser extent Botta's pocket gopher (*Thomomys bottae*), two highly motivated burrow excavators.

December is an important month for California tiger salamanders because the wet season allows for nighttime above ground movement and a brief opportunity to see this highly secretive and specialized native Californian. Above ground movements are almost exclusively from burrows to breeding areas, which can be stock ponds or natural seasonal pools (i.e. vernal pools).

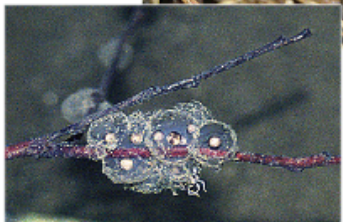
Breeding migrations or "hikes" can be up to a mile and take several days or weeks to complete. The male salamanders arrive first at the pond followed by the females in subsequent rain events. A courtship "frenzy" occurs and breeding follows with the females laying eggs singly or in small clusters (far left).



By Michael van Hattem



The California tiger salamander is thought to live a long life of about ten years. The eggs, left, take about 10-14 days to hatch. The larvae period, right, occurs over a 3-6 month period to eventually become an adult California tiger salamander, center.



season nighttime rains and see if you can catch a glimpse of this unique representative of California's native biodiversity.

The California ground squirrel has long been considered a pest in California because of its impact on agriculture and its tenacity to dig, but ecologically it is a keystone species. A keystone species can be thought of as an animal that once removed from an ecosystem would result in profound changes in the structure and biodiversity of that system. In simpler terms, California ground squirrels build homes for salamanders and frogs and are grassland Twinkies for eagles and badgers.



California ground squirrel

Eggs take about 10-14 days to hatch depending on temperature. The larval period takes 3-6 months, where larvae rapidly develop and feed on a variety of invertebrates and small vertebrates, such as tadpoles. As the pond dries, California tiger salamander larvae absorb their feathery gills and develop lungs and some of their characteristic dark-spotted coloration.

The next step in the salamander's journey is mind-boggling because the formerly aquatic salamander is now faced with the reality of terrestrial existence. In the final days and weeks before the pond dries, larvae (now called meta-

morphs) emerge and disperse into the upland habitat in search of a burrow to call home. The first night away from water is critical because the next day brings temperatures that will be lethal to an exposed salamander. Take a moment and think about how challenging the life of the California tiger salamander is. If the metamorph makes it to a burrow and survives, it may be 4-6 years before it returns to breed as an adult.

The California tiger salamander is a long-lived animal, probably in excess of 10 years, but like many declining species, each adult produces very few offspring. A number of factors including habitat loss and fragmentation, non-native species introductions and mammal control programs (such as ground squirrel control efforts) have led to the California tiger salamander being classified as a Species of Special Concern and now proposed for listing as "Threatened" under the Federal Endangered Species Act. In May 2004, the future of the California tiger salamander may be decided as the U.S. Fish and Wildlife Service will

issue a ruling on whether this state endemic becomes protected under the act. Until then, take advantage of these early season

Geese flocking to inviting urban landscapes



By Laura Burkholder

In 2003, one pair of Canada geese (*Branta canadensis*) nested at LLNL's Livermore Site. This geese population has slowly increased over the years, and this year, four known pairs of nesting geese are at the Lab. The eggs in one nest already hatched and the parents were observed near Lake Haussmann with their new goslings in tow. So, we can expect the remaining nests to produce fuzzy little ones soon.

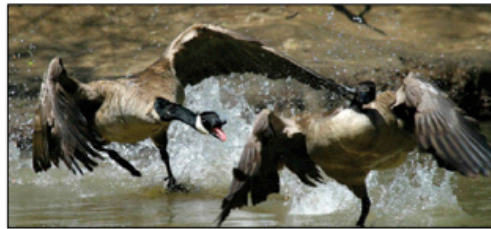
Historically, Canada geese wintered in the continental United States and Mexico. In spring, they migrated north along the Pacific, Central, Mississippi, and Atlantic Flyways to arctic breeding grounds. Canada geese were extirpated from most of their range in the early 20th century as a result of unregulated hunting, egg collecting and habitat destruction. All Canada geese and their eggs became federally protected under the 1918 Migratory Bird Treaty Act, designed to protect native species.

Today, the Canada goose is the most widely distributed and recognized waterfowl in the country. This incredible comeback is attributed to a population increase from stocking captive flocks during the 1960s and 1970s. Recovery of this species has allowed for increased sport hunting and recreational wildlife viewing.

The recovery of Canada goose populations in North America continues, largely due to an increase in resident goose populations. In general, there are two distinct populations of Canada geese, residents and migrants. The geese nesting at the Livermore Site are part of the growing resident Canada goose population that can be found year-round in the lower 48 states. In spring, resident Canada geese remain on or near their wintering grounds, often in the continental United States, to nest and rear their young. Urban and agricultural habitat is often so ideal for these geese that they do not migrate. Current Canada goose populations represent a large recovery to above historic numbers and a great success story of wildlife management.

Life history and behavior

Eleven subspecies of the Canada goose have been recognized, although many are nearly identical in appearance. Flocks of Canada geese are easily identified during migration as they fly overhead in a distinctive



TED STEINKE

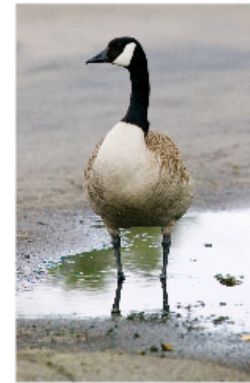
Above: A male goose fends off an intruder. Right: A goose takes a stroll on site. Below: Newborn goslings go for a swim with parents.

V-pattern. Canada geese occur in natural wetland areas and are often associated with human-altered landscapes, such as agricultural fields and manicured lawns. Their primary diet consists of grasses, grains, seeds, and wetland vegetation.

Canada geese are monogamous. Nesting usually begins in March, when the female begins nest construction. Nest sites are usually within 150 feet of a water body and offer wide visibility for readily detecting predators. The female often uses the same nest site in multiple years. She lays about five to seven eggs over several days; incubation lasts for about one month and is performed solely by the female. The male guards the nest area from potential predators and threats. Humans may be perceived as potential threats to the nesting area and can be charged or even chased by an aggressive hissing male.

As the eggs begin to hatch and goslings emerge, males may be aggressive, defending their new family. The geese may remain in the breeding area for about three months while the goslings grow their flight feathers. The adults

molt their flight feathers in June and July, so also are flightless at this time.

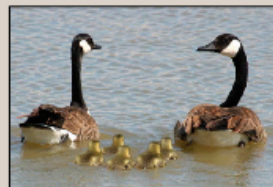


JACQUELINE MCBRIDE/NEWSLINE

Urban Settings: LLNL is not unique

Urban landscapes offer attractive foraging and nesting habitats to Canada geese. Geese are chiefly grazers. Mowed lawns provide geese with new grass shoots. An almost complete lack of predators in urban areas also adds to the appeal. Nesting successes can attract additional geese to an area in subsequent years.

While the geese can be interesting and fun to observe, they are wild animals and conflicts between geese and humans can be a concern. LLNL wildlife biologists are working toward developing a long-term integrated goose management strategy for the Livermore site to address human-wildlife interaction issues.



JACK BINCH

How to avoid conflict

- Do not approach the geese, their nest, or goslings, especially if the geese appear aggressive. Keep at a safe distance. If there is no alternate route and you must approach geese or a nesting area, avoid eye contact and continue walking.
- Please DO NOT feed the geese. Feeding can increase aggressive behavior toward humans and lead to overcrowding of geese in an area. While feeding geese may seem like a benefit to the animals, it can lead to poor health and nutrition and increased disease.
- Call a Wildlife Biologist (4-WILD) if you have any questions or concerns.



Newsline
UC-LLNL
PO Box 808, L-797
Livermore, CA 94551-0808

Striving for balance where rural and urban meet

The Laboratory is located where urban Livermore meets the open space of the Altamont hills. For many species of wildlife, this transition zone between urban and rural is a suitable place to live. Even rare species, including the white-tailed kite and California red-legged frog, are able to survive and reproduce here.

Most Lab employees will never see these rare species at work, but there are many wildlife species that are frequently observed on site including the California ground squirrel, gray fox, striped skunk, pacific tree frog, great egret, red-tailed hawk and common barn owl. Although most of us enjoy being able to look out our office windows and watch a gray fox sneak between hedge rows or see a Cooper's hawk swoop down in pursuit of its next meal, we need to be aware that conflicts often arise in areas where humans live or work in close contact with wildlife.

The Canada goose exemplifies this conflict between people and wildlife. Cities throughout the country have inadvertently created ideal habitats for Canada geese by installing expansive lawns near ponds at parks and golf courses. While many people enjoy having geese and ducks in their towns and cities, flocks of Canada geese have grown to such large numbers in many areas that they are considered a threat and nuisance to people. We had a small taste of these conflicting feelings toward wildlife last spring when one family of Canada geese built a nest on the second story balcony of Bldg. 543. After watching the geese sit on their nest for several weeks and seeing the young goslings just hours after they hatched, many of the residents of Bldg. 543 were in love with the goose family. As the geese grew and spent time foraging throughout the Lab, many people were frustrated by the amount of mess one family of geese could leave behind and some people were frightened by the wild geese when they encountered them on walkways and near the entrances to their buildings.

Gray foxes are also common at the Livermore site. They often live in the crawl spaces under trailers and are frequently seen running out of culverts that cross under roads. Even when living in close



By Lisa Paterson

proximity to people, these animals are naturally shy of people and quickly run for cover when humans approach. Although this tiny elusive fox will avoid people whenever possible, foxes can become aggressive if trapped or threatened.

There are two simple things we can do as Lab employees to reduce the number of problem wildlife/human encounters at the Lab:

- enjoy our wildlife from a distance



MICHAEL VAN HATTEN

California ground squirrels (*Spermophilus beecheyi*) above, are common in the north and west buffer zones of the Laboratory. A family of Canada geese (*Branta canadensis*), right, often roamed near the old central cafeteria last spring.

- never feed a wild animal.

Wild animals that are fed by people can lose their natural fear of humans leading to aggressive behavior, and animals that become aggressive toward or fearless of people must be euthanized. In addition, "people food" is often not healthy for wild animals, and feeding wild animals can cause their population numbers to grow to unnaturally high levels. Feeding wildlife can also inadvertently lead to an increase in populations of pest animals because food left out for wildlife is often consumed by animals such as rats and feral cats.

Birds and wildlife do occasionally behave aggressively toward people, especially when protecting nests or young. If you encounter a wild animal at the Livermore site, step back and observe it from a distance. If the animal acts in an unusual way, contact a wildlife biologist by phoning 4-WILD. (See the Jan. 30, 2004 issue of *Newsline* for a detailed discussion of mountain lions in urban areas.)

The most worthwhile and rewarding wildlife observations occur when people are able to sneak a glimpse of an animal's natural behavior. What a treat to be able to see a white-tailed kite bring a meal to its nest or a mother gray fox sneak her pups across a walkway, or hear the call of an Anna's hummingbird or the chorus of Pacific tree frogs all during a lunch break. Please remember to enjoy wildlife from a distance and never feed a wild animal.



LISA PATERSON

Some like it hot: a look at the coast horned lizard

Picture this: As the late morning sun warms the ground, a prehistoric creature slowly crawls out of his underground lair to bask in the sun. He is fearsome looking and well armed against attack, his body and tail covered in spiny scales, and he sports a large crown composed of six or seven reddish horns projecting devilishly from the back of his head. His body is flattened and tank-like, with a huge round abdomen flanked on both sides by a row of fringe-like scales. Underneath, his belly is bright yellow and cream, while his back is a mottled with brown, rust, cream and black splotches that allows him to blend in to his surroundings amazingly well.

After warming himself in the sun, the reptilian hero begins hunting for his prey — hapless ants and other small insects that wander by. He hunts at a leisurely pace, as he prefers for the food to come to him rather than spending a lot of time and energy zipping around like his more slender lizard cousins do. Later in the day, when he is full of a delicious meal of ants, he will begin looking for a female to impress with a series of vigorous head bobs, pushups and a seductive pawing of the air with his clawed toes. If the female finds this male's antics attractive, she will allow him to flip her on her back and mate with her. If not, she will ignore him and go on her way, or if he is very persistent she may dig a burrow in the soil to escape until he forgets about her and moves on. Hunting, basking and looking for mates continues until the heat of the day becomes too much, at which point our spiky friend will once again retreat underground, where he will nap until it is a more comfortable temperature outside.

This is a typical spring day in the life of the coast horned lizard, *Phrynosoma coronatum*, who roams the hills and valleys of central and southern California. This lizard, which is sometimes mistakenly called a horny toad because of its squat toad-like appearance,



By Jennifer Garrison



PHOTO BY ROBERT POTTS © CALIFORNIA ACADEMY OF SCIENCES

A shorn lizard, above, surveys his land. A puffed-up horned lizard, top right, tries to scare off its human captor. The yellow belly of a coast horned lizard is shown at bottom right. These animals should not be kept as pets, as many die in captivity. The coast horned lizard is a Federal and State Species of Special Concern. The California Department of Fish and Game gives them full protection from collecting, making it illegal to take them from the wild to keep as pets.



PHOTO BY MICHAEL VAN HATTEN



PHOTO BY JENNIFER GARRISON

lives its life in tune with the sun. It doesn't bother getting up until it is warm and sunny outside, and sensibly takes a siesta on hot afternoons. During the cold winter days, it will hibernate underground to avoid the chill. Anyone who spends time in Livermore can appreciate the brilliance of this lifestyle. And of course, any creature that eats ants is surely a welcome guest in most neighborhoods.

An adult coast horned lizard is about four inches long, and seems almost circular when viewed from above. Its stomach is so large because it must consume a

lot of ants to get enough calories to survive (ants are mostly exoskeleton). In addition, females carry a lot of eggs in that round belly, with single clutches ranging from six to 21 eggs. These eggs are laid in nests created in loose soil in April - June, and the tiny spiky hatchlings appear in July or August.

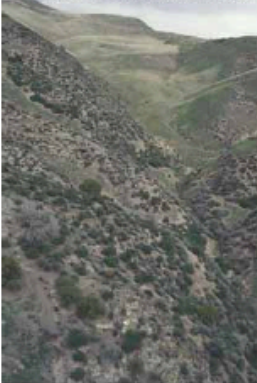
Because it has such a large stomach, the horned lizard cannot run fast to get away from predators (such as loggerhead shrikes, roadrunners, coyotes and foxes). It makes up for this awkwardness by being a good master of disguise. It is virtually impossible to see a horned lizard sitting still from a distance of more than a couple

of feet. The best way to spot a horned lizard is when it dashes away when you get too close. They will almost always stop within a few feet and sit still again. If you are watchful, you can follow it and get a good long look. Should its camouflage fail, the horned lizard's dangerous looking armaments will protect it from many predators. Those that persist in attacking may be repelled by foul tasting blood it squirts from its eyes as a last defense.

Coast horned lizards spend most of their time in open areas with plenty of sun and ants. They live in a wide variety of habitat types, from conifer forests and riparian woodlands to grasslands and chaparral scrub. Around the Tri-Valley area, they can be seen basking in the sun on Mount Diablo, the Altamont hills, San Joaquin Valley and on Site 300 fire trails. The coast horned lizard, once common, is now reduced in number because of habitat loss due to development, pesticide use (which reduces its insect prey), predation by domestic cats, collection by the pet industry and its bad habit of sun bathing on the side of the road. Because it relies on blending in with its surroundings, the coast horned lizard often does not move when approached by predators. However, in the case of an encounter with an automobile this proves to be a poor adaptation, and lizard mortality is high along roadsides. So drive carefully this spring and summer, stay off the roadsides, and keep an eye out for our ant-eating friends.

REFLECTIONS: *Live-trapping reptiles in the coastal sagescrub community, Site 300*

by Jim Woollett, wildlife biologist



The coastal sagescrub is a habitat found on steep-sided, rocky slopes with shrubs and grasses intermixed.

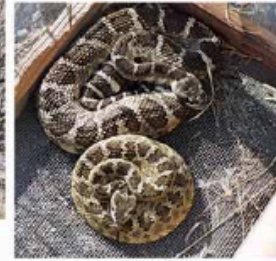
Environmental studies of the air, water, and wildlife at LLNL involve the efforts of numerous programs and staff across the institution. Through the eyes and camera of LLNL wildlife biologist, Jim Woollett, this photo essay gives a rare look at one particular wildlife research project at Site 300. The following photos were collected during ongoing field activities investigating the effects of prescribed fire treatment on a unique California habitat — the coastal sagescrub — and its inhabitants. Coordinated with the assistance of the U.S. Fish and Wildlife Service, the project requires the live trapping (and release) of special reptile species that are of particular interest to land managers in this region. During the research, as seen in these photos, a diversity of wild animals are encountered.



Trapping reptiles for study requires the right equipment: snake tongs and sheltered traps that provide cover from the extreme summer temperatures.



Even the rabbit slows down when ground temperatures exceed 110 degrees Fahrenheit.



Oh boy! Two rattlesnakes in one trap.



A juvenile skink is a small and shifty character to handle.



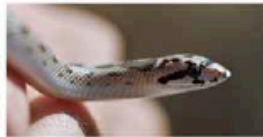
Tracking a lizard across the sand.



Red racers are normally too quick to photograph.



A longnose snake is known as a sharp-dressed reptile of the scrub.



Born a few weeks earlier, this glossy snake is hungry and looking for food.



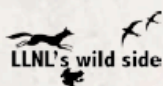
These centipedes are best left alone.



You never know who may be watching you.



Deer herds find particularly nutritious forbs around sagescrub patches.



A day in the life of a Lab archaeologist

By Kelly Heidecker

Did you know that the Lab has an archaeologist on staff?

Would you be surprised to learn that the Lab and Site 300 are home to several prehistoric and historic archaeological sites as well as several historic buildings and districts? You shouldn't be.

California's Central Valley, including Livermore, has been inhabited by the predecessors of groups known today as the Costanoans (Ohlone) and Northern Valley Yokuts for at least the past 9,000 years. The Livermore-Amador Valley, within which LLNL is located, also experienced Spanish exploration and settlement, European and American mining, early industry and ranching. Although familiar to most, more recent history includes the establishment of this Lab — over 50 years ago — on land originally occupied by the Livermore Naval Air Station. Constructed in the 1940s, this naval air base supported the United States' war effort during World War II.

The role of the archaeologist at LLNL is to assist the DOE/NNSA in fulfilling its responsibilities under the National Historic Preservation Act. This Act requires Federal agencies to take into account the effects of their operations on historic properties and allow for a reasonable opportunity for the Advisory Council on Historic Preservation to comment on these proposed activities. An additional policy, DOE Management of Cultural Resources, establishes that preservation and protection of America's cultural heritage are important functions and responsibilities of the DOE, NNSA, and its contractors for properties under their jurisdiction. These two regulatory drivers underlie the work of the Lab's archaeologist/cultural resource specialist.

Along with other colleagues in the Environmental Protection Department, the archaeologist ensures that the Lab's mission and programs are carried out in a manner that fulfills its responsibilities to protect natural and cultural resources at both sites. This includes working hand-in-hand



JACQUELINE McBRIDE/NEWSLINE

Kelly Heidecker is the Lab's archaeologist who works out at Site 300.

with wildlife biologists, environmental scientists and analysts, and the program staff themselves.

On any given day, the Lab's archaeologist conducts a variety of activities to support the identification, evaluation and recording of the archaeological sites and historic buildings located on-site. Intensive surveys of the Livermore site and Site 300, conducted over the past 20 years resulted in the development of Geographic Information System (GIS) maps that delineate areas as more or less sensitive for encountering archaeological sites and historic buildings. Prior to any ground-disturbing activities in these locations, the archaeologist determines if any historic or culturally significant sites

exist in the project area, or are likely to be found, and if so, discusses precautions to carry out the project with minimal disturbance to the site(s).

Occasionally, the archaeologist can be found monitoring earth-moving activities if the project is close to a known site, or in an area where new sites might be found. When projects are proposed that might affect one of the five historic buildings or two historic districts (significant for their association with the Lab's involvement in the Cold War period), the archaeologist provides an evaluation of whether or not the project would cause the historic property to lose the characteristics that make it historic, and if so, suggests alternatives that would allow the project to proceed while minimizing impacts to the historic value of the property.

Stay tuned for future cultural resource columns; a series of topics is in the works. Topics will include a primer on historic building classification and the significance of this designation, as well as articles that describe LLNL historic properties and their unique characteristics and significance. Take a walk through history and the cultural side of the Lab through this series of articles.

For more information on the National Historic Preservation Act of 1966, to <http://www.achp.gov/nhpa.html>. For more information on the DOE Policy Management of Cultural Resources, see <http://www.directives.doe.gov/pdfs/doe/doetext/neword/141/p1411.pdf>.

The LLNL archaeologist/cultural resources specialist, Kelly Heidecker, can be reached at 3-8579 or heidecker2@llnl.gov.

POSTED STD
U.S. POSTAGE
PAID
LIVERMORE, CA
PERMIT NO. 15

LINDL, from page 5

could be reached by reducing the laser wavelength "gave us a path forward to getting the target conditions we needed for ignition," he said.

Lindl played a central role in the Nova laser program, which ran from 1984-1999 and was a true workhorse for revealing key physics constraints which led to refining the target designs required for ignition. Some of the key physics results from Nova included precision control of capsule symmetry, effective use of laser pulse shaping to increase fuel density, and reduced hydrodynamic instability during a capsule implosion in agreement with calculations.

"A key piece of our success was development of advanced diagnostics," Lindl added. This included X-ray framing cameras, which made it possible to take movies of an imploding capsule during the nanosecond-long laser pulses, and Thomson scattering for probing the conditions of laser-heated matter inside the targets.

Advances in computing capability have been

equally important to the development of ICF. Since the start of the Advanced Simulation and Computing (ASC) effort within the Stockpile Stewardship Program, computing capabilities have increased by about a factor of 1,000. This enormous increase in capability has enabled 3D calculations of laser beam propagation, capsule hydrodynamic instability, and target symmetry that would have been impossible 10 years ago. Calculations that take a million CPU hours or more are now a central part of preparations for ignition experiments.

Summing up, he said, "We believe we can do these experiments to the precision needed. The target designs we are developing for the first ignition experiments have a credible chance for ignition, if we meet the specifications. But the integration of the laser, targets, diagnostics, experiments and modeling into a smoothly functioning system with the precision we require is a grand challenge which is likely to take a few years." Lindl went on to comment that these initial ignition experiments only scratch the surface of what NIF will be able to accomplish.

Newsline
LLNL
PO Box 808, L-797
Livermore, CA 94551-0808

Believed extinct, rare jewel blooms at Site 300

The diamond-petaled California poppy (*Eschscholzia rhombipetala*) was thought to be extinct for approximately 50 years when it was rediscovered in the Carrizo Plain in San Luis Obispo County by a botanist from Cal Poly, San Luis Obispo. A second population was found at Site 300 in 1997 during a habitat survey, and an additional population was again found at Site 300 in 2002. These are the only locations where the diamond-petaled California poppy is currently known to occur worldwide.

Both Site 300 locations are found in remote areas away from programmatic activities. The diamond-petaled California poppy was probably never wide spread and remains one of the rarest plants in California. Only seven historic populations are known. All historic populations were found in the inner Coast Ranges in Contra Costa, Stanislaus and San Luis Obispo counties. The Corral Hollow area, where Site 300 is located, is known for its diverse flora including several extremely rare species. Four hundred and six species of plants are known to occur at Site 300. Eight of these are considered rare plants or limited in distribution.

California is a state rich in native plants. More than 6000 species of native or naturalized plants occur in California, more than occur in the entire northeast United States and adjacent portions of Canada. More than 16 percent (1,020 species) of these plants are considered rare or endangered by the California Native Plant Society (CNPS). Another 8 percent (554 species) of California native plants are included on CNPS's watch list of species of limited distribution; these are species identified at risk for becoming rare, including the diamond-petaled California poppy.

The diamond-petaled California poppy is a small annual forb (broad leaved non-woody plant). Diamond-petaled California poppies found at Site 300 are typically less than 15 centimeters tall when flowering. The diamond-petaled California poppy has small yellow flowers unlike the showy orange flowers of its common relative the California poppy (*Eschscholzia californica*). In addition to its larger size and orange



By Lisa Paterson



DINA CARLSEN

Diamond-petaled California poppy (*Eschscholzia rhombipetala*)

petals, the California poppy can be distinguished from its rare relative by a disk shaped rim on the receptacle that is found directly below the petals of the California poppy.

Research conducted at Site 300 by LLNL's Environmental Protection Department has focused on determining the ecological requirements of the diamond-petaled California poppy. This rare poppy is a grassland species that is typically found in heavy clay soils. At Site 300, this species occurs in and around small patches of open bare ground caused by slumping hillsides. As is common with many grass-

land forbs in the Livermore area, the California diamond-petaled poppy only flowers during a short period from late March to early April.

The causes for the extreme rarity of the diamond-petaled poppy are unknown. Throughout California many plant species are rare because they occur in habitats that naturally have a limited distribution, such as plants restricted to rare soil types (e.g. serpentine endemics). Other plant species become rare through human impacts to their habitats, as is the case with many vernal pool species. In addition, some California species are thought to be rare because they are "old" species, such as the Torrey pine (*Pinus torreyana*) that were once more widely distributed and became more restricted in their distribution because of climatic changes.

As the weather gets warmer and the days get longer over the next few weeks, the annual forbs that make up a large part of the grasslands that surround the Livermore site and Site 300 will come to life forming patches of color on the Livermore hillsides. Though very few people will be lucky enough to see the rare and diminutive California diamond-petaled poppy this spring, look for the beautiful patches of color formed by more common annual forbs on the hillsides that surround the Livermore site and Site 300. Some common spring colors in the Livermore area

are purple owl's clover (purple/pink) (*Castilleja exserta*); common fiddleneck (orange) (*Amsinckia menziesii*); cupped monardella (yellow) (*Monardella major*); and blue dicks (purple/blue) (*Dichelostemma capitatum*).

JO ANN ORDANO © CALIFORNIA ACADEMY OF SCIENCES

Left, purple owl's clover (*Castilleja exserta*); above, blue dicks (*Dichelostemma capitatum*); below, California poppy (*Eschscholzia californica*)

DR. ALFRED BROUSSEAU, SAINT MARY'S COLLEGE



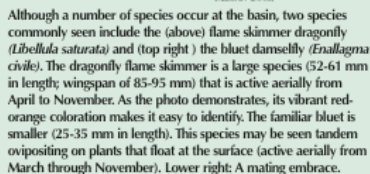
BETH LEGER

While walking around the small, aquatic basin near the Central Cafeteria, it's easy to miss the graceful, speedy movements of a myriad of dragonflies and damselflies. Yet, with some heightened vigilance, one of the Lab's smallest inhabitants is within eyesight. Startlingly intricate designs, vibrant colors, and awesome acrobatic moves reward the keenly focused eye.

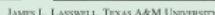
Both dragonflies and damselflies comprise the insect order known as *Odonata* (meaning toothed jaw), although dragonflies belong to the suborder *Anisoptera* (unequal-winged) and damselflies to the suborder *Zygoptera* (yoke-winged). California is home to more than 60 of the over 5000 extant species of dragonflies and damselflies; yet, these 60 species represent all seven families that occur across the U.S.

At the basin's edge, these aerial artists are commonly found; yet, is it a dragonfly or a damselfly? A simple way to distinguish one from the other is to compare the two while at rest. The dragonfly will keep its wings out flat, while the damselfly will hold its wings over its abdomen. The larvae of both species are strictly aquatic; damselflies have feathery gills at the end of their abdomen; dragonflies don't. Other variables also differentiate the two insect groups. The heavier bodied, larger, and stronger fliers typically are dragonflies; while damselflies are smaller, more slender, and weaker fliers. Despite their differences, both insects are commonly and collectively referred to as dragonflies.

It's not unusual to catch a glimpse of a dragonfly pair clutched together in flight above the water's surface. This unique and complex ritual offers a fascinating glimpse into their breeding behavior. Surprisingly, even insects are territorial and males may defend an area in anticipation of mating with a female (often termed resource defense territoriality). Males may also gather together — perched in vegetation awaiting females or actively scout for their partner by flying up and down the water's edge or within the adjacent vegetation. Although females spend much time



Upon finding their mating match, the dragonflies fly in a tandem pair to a perch. This tandem consists of the male clasping the female by the head and flying with the male in front and the female following. If lucky, you'll then see the mating "wheel" formation (see photo), in which the female bends her abdomen forward and downward to connect with the male's genitalia for an equally complex sperm transfer to occur. Mating may last in this position for several seconds to hours (species specific). The subsequent egg



Metamorphosis from larva to adult (Widow skimmer, *Libellula luctuosa*): 1) larva thorax splits, 2) adult begins to metamorphose, and 3) newly emerged adult.

Scott Wilson/PAC

Member's of the Laboratory's Cool Scientists Drill Team marched in Livermore's Rodeo Parade June 11.

The period at the end of this sentence is about the size of most dragonfly eggs; hatching occurs weeks later. Unlike most helpless bird hatchlings, dragonfly parents do not fend for nor feed the larvae (nymphs) that emerge from these minute eggs. Yet, dragonfly larvae are precocious aquatic predators. Not fussy eaters, their underwater crawling results in opportunistic stalking, hunting, and ambushing of prey, eating any animal their size or smaller. Even a sizeable meal of small vertebrates like tadpoles, fish fry, or other dragonfly larvae may make up this random meal. Similar to birds, the larvae undergo molting (or "instars") and will molt about a dozen times over the months or years needed before crawling out of the water to emerge as an adult. The larvae undergo direct metamorphosis to their adult life stage.

Seemingly out of a horror movie, metamorphosis is spellbinding (see photo sequence). Once perched (perhaps on a branch or rock) out of the water, the "skin" over the larva's thorax cracks and the adult, winged dragonfly slowly emerges out of this broken shell. Over a matter of hours, it's legs harden, body and wings expand, mature and harden, and colors fully develop. A glassy sheen to the wings indicates a new ("teneral") adult. The new adult is then mobile.

Their showy designs and colors, belie attributes that go far beyond their shell-deep beauty. Adults use their keen eyesight and quick aerobiotic ability to hunt their insect prey. Although flight speeds may reach up to 25–30 mph, average cruising speeds for bursin species are nearer to 10 mph. Adult dragonflies tend to have a short lifespan (weeks to months). This brief aerial adulthood allows for feeding, maturation, and mating. Similar to migratory birds, a few dragonfly species may disperse over great distances, even across oceans. However, many more remain closely tied to their larval habitats (site fidelity).

Some believe that these "toothed jaw" or serrated jawed insects may sting or bite humans, but this is merely a tale. Yet adult dragonflies are fearsome predators to other insects. These aerial predators with voracious appetites provide the benefit of keeping pest insects in check (for example, gnats and mosquitoes). Conversely, dragonflies constitute a key part of the basin's amphibians' diets, like the federally threatened California red-legged frog (*Rana aurora draytoni*).

To enjoy more articles about LLNL's wildside, please visit http://www-envirinfo.llnl.gov/wildside_articles.html



Newsline
UC-LLNL
PO Box 808, L-797

Fire ecology has been a burning issue through the ages

Fire has been linked to the natural dynamics that historically have shaped plant communities and animal populations throughout California. Fire became a tool commonly used by early inhabitants of the state to promote: effective hunting for big game; improvements of the landscape for dwellings and cultural activities; and curtailment of pest and disease outbreaks.

Recent catastrophic, fire-related events across the state have drawn attention to "adequate fuel" (e.g., woody debris) reduction and management practices. Many federal and state institutions with land management responsibilities are studying new aspects of fire ecology as well as the history explaining how the flora communities and vegetation types currently found in the state established themselves.

Prescribed fire treatment is a method of reducing hazardous natural fuels in an area and/or rejuvenating vegetation to reach a targeted, ecological result. For instance, fire may be used by an agency to regenerate timber stands in areas that have been previously logged and that require an environmental stimulant to promote restoration and reforestation of the land.

Prescribed burning is an annual landscape management procedure implemented at the Laboratory's Site 300 under carefully planned, permitted and monitored conditions. Specific buffer areas of grassland habitat are burned to protect site facilities from the hazards of wildfire during dry summer conditions. Consistent with the practice, these grassland habitats display healthy suites of native plants not visible in other areas of the property. Fire frequency in this region of California has historical precedent. Native wildlife species have developed particular adaptations to survive in these fire-driven ecosystems.

Evidence suggests that the native people of this region of California (the interior coastal region) substantially altered the early vegeta-



By Jim Woolett



Annual burning at Site 300 takes place to protect the area from potential out-of-control wildfires.

tion communities from patchy shrublands to grasslands through the use of routine, prescribed fires. Widespread chaparral shrublands are believed to have existed at this location in early times. In many cases, this chaparral formed dense, nearly impenetrable stands.

For native people, these stands represented an obstacle to food resources, made travel difficult, sheltered large predators such as grizzly bears and mountain lions, and consumed much of the surface spring water available. Incorporating fire into their lifestyle

allowed these people to "farm" for seed-producing plants that responded to burned areas and subsequently yielded high quality food sources similar to an agricultural effort. Animals such as deer, quail and rabbits, which preferred the more open environment, were drawn to these areas, providing important food sources for local inhabitants.

Colonial Spanish missionaries who immigrated to California in the late 1700s are believed to have discovered an open landscape in the interior coastal range ripe for livestock and farming. With the release of European cattle, many of the plants that had occupied burned shrubland areas were taken over by non-native grasses introduced with the old world animals. These exotic grasses produce the "golden" hills that now typify California topography.

Many of California's wildlife species have adapted to avoid the hazards of the dry season when vegetation fuel levels are highest and most flammable. Ground-nesting birds typically nest early in the season when moisture is still present in plants close to the soil surface. Small mammals may "hibernate" or estivate during the summer in grassland or chaparral areas that have been burned and that lack adequate food. Larger, herbivorous mammals migrate to the high ground in the winter

for succulent grasses and associate with lower, wetter climates in the summer. Many of the smaller, more prolific animal species live underground or shelter in rock outcrops, safe from the heat of a fire.

Fires have guided the adaptations present in California plant life and animal communities. Restoring fire cycles in some areas may help safeguard human life and property and sustain wildlife diversity in the interior coastal ecosystems far into the future.





Local effort to protect majestic golden eagle takes wing

Both the Laboratory's Livermore site and Site 300 reside within one of the largest known populations of golden eagles in the world. Eagles have been observed hunting ground squirrels in the buffer zones of the Lab's main site and nesting on remote hilltops at Site 300. This federally protected bird-of-prey has special meaning to native peoples as well as other area residents today, particularly because of the wild lands it calls home.

They are found from Northern Alaska and Canada southward through the intermountain regions (Rockies, California's Coastal Ranges, etc.) to central Mexico and western Texas. The numbers of breeding pairs within the U.S. has been estimated to be only about 17,500 pairs.

The golden eagle is not directly related to the bald eagle, our national symbol, but would be more aptly described as a distant cousin. In an ecological role, bald eagles tend to be associated with water and fish populations whereas the golden eagle is found in interior, upland areas that are drier and offer small mammals, such as ground squirrels, as a food source.

Recent efforts to understand the local eagle population reveal several significant threats to the birds. The Laboratory is working to protect the local population of golden eagles.

Protecting the local eagle population

In the mid-nineties, Site 300 participated in a golden eagle population study that included the Altamont Pass and Wind Resource Area. The University of California, Santa Cruz (Predatory Bird Research Group) led the study in assessing the demographic attributes of eagles that lived and foraged within the Diablo Mountains. The initial study was funded by the wind industry and the Department of Energy's National



Measurement of golden eagle wing by researcher.

Photos by Jim Woollett



Soaring immature bald eagle (shows similar coloration with golden eagle).



A nest platform for a pair of nesting eagles.

All about the golden eagle

The golden eagle (*Aquila chrysaetos*) is among the largest birds-of-prey in the United States with wingspans reaching 2.3 meters (7.5 feet) and weighing up to 7 kg (15.4 lbs).

Size: Female golden eagles are typically larger than males by roughly 25 percent. This difference is likely due to the role each gender plays during the breeding season. Female eagles incubate and guard the nest while the male provides food. The larger size of the female improves her ability to brood eggs and defend the nest site, while the male's smaller size allows him improved acceleration and the ability to carry larger prey relative to his weight.

Coloration: Golden eagles do not display adult plumage until their fifth year. The adult plumage is primarily dark brown and distinct from the juvenile which has conspicuous white feathers on the underside of the tail or in the wings at the carpal joints. The recognized "golden" coloration on the neck and head of adult birds are aged feathers that have become bronzed (bleached) from the sun over time.

Habitat: Golden eagles prefer open, topographically-rich terrain typical of the Diablo and Coast Ranges. Throughout the western U.S., golden eagles can be found inhabiting foothills and mountains in arid and Mediterranean climates. Much of the remaining eagle habitat in Central and Southern California occurs on private ranches and properties that are remote islands of open shrublands or oak savannas.

Food sources: Prey eaten by golden eagles in the interior coastal range consists mostly of ground squirrels and jackrabbits. Golden eagles



will consume carrion in the winter when food is scarce and are capable of exploiting waterfowl concentrations (i.e., migratory ducks and geese) as well. Prey diet can also include snakes as their frequency or availability allows.

Breeding behavior: A particular flight pattern referred to as "undulating flight" is commonly exhibited by eagles in this area. This display consists of a series of steep dives and resulting upward stall-outs with wing-flapping at each apex. Undulating flight is considered to be a courtship presentation, but also may be used to demonstrate territoriality.

The relatively long length of time (generally 5 years) required before an eagle can breed coupled with "similarity of appearance" between both juvenile bald and golden eagles led to the congressional approval of the Eagle Protection Act of 1940. This Act protects bald and golden eagles, their nests, eggs, feathers and occupied habitat, from disturbance and "take" without the appropriate federal and state permits. This law has assisted in the recovery of both golden and bald eagles in regions where they both occur.

Renewable Energy Laboratory and relied on the use of small radio telemetry devices that tracked individual birds from birth to death.

Tens of golden eagles that were resident at Site 300 were captured/outfitted with radio-transmitters and released during this time period. A total of 179 eagles were caught in the Wind Resource Area (including those at Site 300) and each were tracked for over four years. Results indicate that on average 40-60 sub-adult and adult eagles are killed by wind turbines in this area each year.

Eagle wingspans are large enough to span the live conductors on most utility poles and up to 70 percent of the bird electrocution fatalities in the western U.S. are estimated to involve eagles. During 1994-1997, Site 300 installed protective covers on power pole conductors that are preferred perches for birds-of-prey species on the property. These protectors were instrumental in saving numerous hawks and eagles from electrocution. Additionally, in 1997 a nest platform was established for a pair of eagles that were attempting to nest on an adjacent power pole. A potential fatality was avoided.



Golden eagle lifting from its perch (high voltage powerpole) showing phase protection to avoid electrocution (black object on center phase) at Site 300.

Over the past 15 years, interest in protecting and studying golden eagles in the Altamont Pass region has involved dedicated researchers from the state and federal governments, private institutions, and the public-at-large. What they have learned is invaluable to making key wildlife management decisions pertaining to the survival of this unique population of birds-of-prey.



Newsline
UC-LLNL
PO Box 808, L-797

Native California grasslands transformed over time

The unmistakable shifting color of the surrounding grasslands marks the seasons' movement through the year at LLNL. While the Livermore skies have been filled with lumbering, slate gray clouds that pull along damp chilly breezes, the expanse of grasslands beneath dazzles the eye with a vibrant lime green hue. Although these grasses will not grow much until spring, the swaying fields distinctly tell us that spring is coiled tightly and about to let loose. Then the golden grasslands will sway again, with rains surely gone for months to come.

Most of us are aware of the staggering loss of California wetlands and riparian areas (i.e., 91 and 89 percent, respectively). Yet most remain unaware that California has lost 99 percent of its native grasslands. One-fourth of the state was once covered with native perennial grasslands; now only small, patchy remnants remain. Despite incurring the highest percentage loss, native grasslands remain less protected than other ecosystems. While grasslands in this area seem ubiquitous (their extent is relatively preserved), the character of these grasslands has absolutely changed.

Two broad categories of California grasslands exist: coastal and valley grasslands. Valley grasslands largely occur across flat areas in the Central Valley, yet also rise over the low-lying, surrounding foothills. Native valley grasslands were dominated by perennial species, although sparse historical information leaves uncertainty about the specific plants. These native valley grasslands were lost in two ways: many were entirely obliterated for cultivation or development while others were lost through significant alterations.

No single cause resulted in this rapid, dramatic habitat loss and conversion (esp. 1850-1880s); rather, multiple factors worked in concert. Factors included non-native plant and wildlife (livestock) introductions, altered grazing pressures, cultivation, development and fire suppression. High grazing pressure diminished native perennial grasses and favored exotic annual plant species. Cultivation also altered the landscape with agricultural fields entirely replacing grasslands. This allowed Mediterranean grasses to take hold, species that are more resilient to variable weather and grazing conditions. A shift from a perennial to annual dominated grassland occurred, forever changing the character of its habitats, wildlife communities and overall ecosystem health.

Site 300 offers a rare glimpse of



By Jessie Coty

what these native California grasslands may have looked like before Europeans arrived. Site 300 is a small remnant, a 477-acre history book of sorts. The dominant plant in this remnant is one-sided bluegrass (*Poa secunda*) with some purple needle-

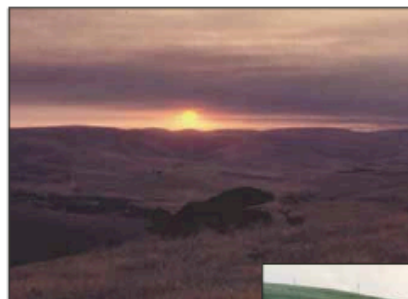
grass (*Nassella pulchra*). A positive legacy of federal land ownership is that these usually large, relatively undeveloped expanses of land often provide an oasis for wildlife, plants, and ecosystems. At Site 300, annual controlled burns favor native perennial grass species.

Yet more than 80 percent of the habitat at Site 300 is now comprised of exotic California annual grasslands, widely rolling over 5,533 acres. Seeds are stored over the dry season in soil seed banks, remaining viable for several years. Each square meter of soil under these grasslands may store between 300 to 150,000 seeds.

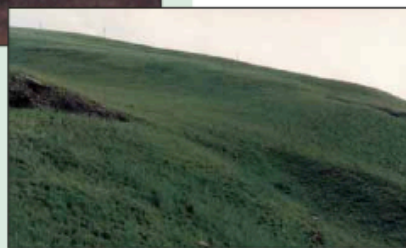
Once the first fall rains exceed 15 millimeters, the seeds germinate and slowly grow over winter. In spring, the plants rapidly grow, maturing between late April and June.

Grasses are flowering plants, just like the vibrantly (exotic) yellow-petaled mustard flowers now widely blooming within these grasslands. Yet, grasses rely upon the wind for pollen transfer rather than insects. Why put energy into developing colorful, showy flower parts when these are unneeded to attract insects? Rather, grasses have anthers (pollen sacs) that dangle from slender stalks or filaments; the stigma (part of the flower that captures airborne pollen) is often large and feathery. Not overly charismatic, yet efficient.

Grasslands tend to occupy vast geographical areas; protecting them conserves open space, habitats and biodiversity. Other benefits of both native and exotic grasslands include carbon storage, high primary productivity, economic value (e.g., herbivore productivity) and aesthetic value. Native grasslands support a diversity of species that differ from the more common annual exotic grasslands. Although the pristine California valley grassland is nearly gone, the existing naturalized ("new natives") grasslands provide many of the same benefits as native grasslands, and as such are worthy of appreciation, enjoyment, and protection.



Above: Site 300 annual valley grasslands: the "new native" grassland ecosystem?



Right: Site 300 grasslands dominated by one-sided bluegrass in spring.

TINA CARLSEN



GARY A. MONROE

Purple needlegrass
(*Nassella pulchra*)



GARY A. MONROE

One-sided bluegrass
(*Poa secunda*)

Dr. Jekyll and Mrs. Hyde: Life of the tarantula wasp

Fall is an excellent time to catch a glimpse of the hairy beasts of the spider world at Site 300 and in grasslands around the Livermore area.

The tarantula is the largest of the spiders found in the region, with a body up to two inches in length and legs three to four inches long. The mating season for the tarantula begins in October and continues until mid-November. During this time, mature males can be seen roaming across the roads and grasslands at Site 300 searching for a mate. The female tarantulas do not roam and will often occupy the same hole or rock for many months or even years at a time.

Unlike most spiders, tarantulas do not spin webs to catch their prey, which consists of small insects and sometimes lizards. Instead, tarantulas chase their prey on the ground and live underground in burrows. Normally, females can live up to 25 years or more, while the males are not quite so lucky, often being eaten by the females after mating. Some tarantulas, however, meet a far more gruesome death than cannibalism. Much like the plot of a bad horror movie, some unlucky tarantulas become a victim of the "body snatchers" of the insect world – the parasitic tarantula wasp.

Tarantula wasps (*Pepsis* spp.) are parasitic insects that use tarantulas as live hosts, or food for their developing larvae. The brightness of the orange-red colored wings of this two-inch-long, black wasp is a warning to other creatures, including humans, that it is dangerous and should be avoided. Its sting is the most painful of any North American insect (although it is less poisonous to humans than a honeybee). Only the female tarantula



MICHAEL VAN HATTEN/EPD

Tarantula wasp (right) and its innocent victim, the tarantula (above). The bright coloration of this wasp gives warning that it may be wise to steer clear of it. The tarantula wasp can deliver the most painful sting of any North American insect and its young eat tarantulas alive.

wasps can sting but its use of that sting has made the tarantula wasp the tarantula's fiercest and most dreaded enemy. Ironically, even though they look more frightening than the attractive tarantula wasp, tarantulas are

quite harmless to people and will rarely bite unless handled roughly.

When a female tarantula wasp is ready to lay her eggs, she uses her sense of smell to find a tarantula. She then stings the tarantula, which permanently paralyzes it. The wasp, despite being half its size, drags the tarantula into a burrow, lays a single egg on its abdomen and then seals the burrow. Once the wasp larva hatches, it feeds on the juices of the still-living but paralyzed tarantula until the larva reaches its last molt stage. Then the new adult wasp tears open the tarantula and feasts on the organs of the tarantula. This last act spells the end for the tarantula. After this gruesome beginning to life, the tarantula wasp lives the rest of its life as a peaceful nectar eater...until it is once again time to reproduce. This is when the female tarantula wasp makes its transition from Dr. Jekyll to Mrs. Hyde, searching the grasslands for its next victim.



Effort to restore endangered fiddleneck blossoms

Scientists in LLNL's Environmental Protection Department are working to restore populations of the critically endangered large-flowered fiddleneck (*Amsinckia grandiflora*), a plant on the brink of extinction.

The large flowered-fiddleneck is an annual plant that historically found in several grassland locations in the hills of eastern Contra Costa and Alameda counties and western San Joaquin County. There are currently only two known natural populations of the large-flowered fiddleneck. One population is located at Site 300 and another is located on a private ranch near Site 300 (referred to as the Carnegie Canyon population).

Researchers at Mills College began restoration of large-flowered fiddleneck populations in 1988. These efforts focused on determining the factors necessary for the establishment of additional populations of large-flowered fiddleneck, and have resulted in at least one successful experimental population at Lougher Ridge in Black Diamond Mines Regional Park near Antioch. Between 1993 and 1995, using funds obtained through the Laboratory's Directed Research and Development Program, LLNL researchers teamed with researchers from Mills College to further investigate the causes of the large-flowered fiddleneck's rarity and established an additional experimental population at Site 300 near the native Site 300 population. Ongoing efforts have been funded by grants from the U.S. Fish and Wildlife Service, the U.S. Bureau of Reclamation, and Site 300 management.

Large-flowered fiddleneck populations have been greatly diminished in recent years. Last spring the native Site 300 population contained only three large-



flowered fiddleneck plants and has had less than 50 plants each year since 1999. These population numbers are down from the 1960s when thousands of plants of this species were found in the native Site 300 population. These population declines have also been observed in the native Carnegie Canyon population and the experimental populations at Lougher Ridge and Site 300.

In an effort to boost these populations, LLNL ecologists planted more than 6,000 large-flowered fiddleneck seeds at the Lougher Ridge and Site 300 experimental populations in the fall of 2002. A wet fall in 2002 followed by a dry winter resulted in poor success with the seeds planted in 2002. Because of this, seeding efforts were repeated in the fall of 2003 with more success and resulted in more than 700 large-flowered fiddleneck plants, which survived to flower in the spring of 2004 at each site.

LLNL scientists also continue to conduct research, initiated in 1993, at Site 300's experimental population to determine the ecological requirements of large-flowered fiddleneck. Long term research at the Site 300 experimental population, and data from management of the Site 300 natural population indicates that competition from exotic annual grasses contributes to the decline of large-flowered fiddleneck. Long term management to reduce exotic annual grass cover and restore and maintain the native perennial bunch grass community is necessary to ensure the persistence of this species.

Through these research and restoration activities, we hope to insure that the large-flowered fiddleneck populations can be sustained, and that this rare native plant continues to be one of the many things that make Site 300 a unique and interesting place.



DON GONZALEZ, LLNL



Left: Although the large-flowered fiddleneck, *Amsinckia grandiflora*, is rare, other species in the fiddleneck genus (*Amsinckia*) are quite common. Upper right: The small burned plots are part of an ongoing experiment to determine the effect of prescribed burns on large-flowered fiddleneck success. Lower right: Ecologists from LLNL's Environmental Protection Department plant large-flowered fiddleneck seeds using frames to assist with precision placement and spacing of the seeds.

Shrike's small size at loggerheads with killer reputation

Through recent ornithological work at Site 300, Environmental Protection Department (EPD) wildlife biologists have discovered an impressive diversity of both resident and migratory avian species. With more than 115 species of birds documented using or residing at Site 300, it's not difficult to find interesting examples of avian ecology and natural history. Yet one species seems to stand out in every flock: the Loggerhead Shrike (*Lanius ludovicianus*).

In recent months, Loggerhead Shrikes have received a significant amount of attention at Site 300 because of their interesting ecology, role in the food Web, site-wide distribution and potential as a sentinel organism for environmental monitoring. This 50-gram wonder is a tenacious predator although it's not considered a raptor (i.e., hawk, eagle or falcon). Rather, the Loggerhead Shrike is a passerine (i.e., song bird, Order *Passeriformes*, Family *Lanidae*) and is best known (and loathed by some) for its habit of impaling prey on thorny bushes and barbed wire. Because of this, the Loggerhead Shrike is known as the "Butcher Bird" in some parts of the country.

Loggerhead Shrikes prefer open grassland savannah habitats of Site 300, areas characterized by open expanses of grasslands with a smattering of suitable nest trees such as junipers (*Juniperus californica*) and valley oaks (*Quercus lobata*).

At Site 300, the Loggerhead Shrike is a relatively common year-round resident, found in populated areas such as the General Services Area to the most remote corners of the site. Loggerhead Shrikes build sturdy nests out of small diameter twigs and grass and have clutch sizes between four to six usually between March and July. Loggerhead Shrikes may have more than one clutch and may reuse the same nest from year to year. After breeding is complete and the young have fledged, adults hold separate but adjacent territories until the following breeding season when they reform as a pair and hold a single larger territory. Young



MICHAEL G. VAN HATTEM



STEVE DOLAN

Upper left: Loggerhead Shrikes build sturdy nests out of small-diameter twigs and grass and prefer dense bushes like this juniper (*Juniperus californica*) at Site 300. Above: An adult Loggerhead Shrike (*Lanius ludovicianus*). Upper right: An adult Loggerhead Shrike being color banded with plastic leg bands for individual recognition. Lower right: An unlucky Pacific treefrog (*Hyla regilla*) impaled on barbed wire by a Loggerhead Shrike.

are differentiated from adults by juvenile plumage (i.e., wing bars and mottled breast feathers) and adults are monomorphic (i.e., males and females look alike).

EPD wildlife biologists are currently studying the Loggerhead Shrike because they appear to be

an ideal sentinel organism for environmental monitoring, filling a predatory niche and holding small, manageable territories (versus hawks with large territories). Current research focuses on whether the Loggerhead Shrike is bioaccumulating a suite of metals found at Site 300. To address these questions, resident birds are captured and non-lethal techniques such as blood and feather samples are collected and compared to birds at a control site near Brentwood, Calif. In addition, nesting birds were monitored through the breeding season and productivity was noted (i.e., clutch size and nest success).

Prior to release each bird is marked with a uniquely colored leg band and aluminum U.S. Geological Survey leg band. Color banding individuals allows for re-identification without the need for re-capture.

In California, the Loggerhead Shrike is a state species of special concern; meaning that it receives conservation consideration under the California Environmental Quality Act, a law that requires developers to evaluate impacts of their projects on this species. In other states and provinces of Canada, the Loggerhead Shrike is declining, considered rare or protected under more stringent environmental laws. The Loggerhead Shrike is one of 15 species recognized by the Commission of Environmental Cooperation as a species of transboundary/ migratory concern.

Research on the Loggerhead Shrike is conducted under Institutional Animal Use and Care Permit #178 and appropriate state and federal permits. For details on this work and other ornithology projects at Site 300, contact van Hattem, 4-6795.

View previous Wildside articles by this author and others at the LLNL Wildside Series Archives at <http://www-envinfo.llnl.gov/>.



MICHAEL G. VAN HATTEM



MICHAEL G. VAN HATTEM

Birds of a feather flock to local sites for the winter

Winter seems like a bad time to watch birds – after all, birds are often scarce in the colder states because they have flown south to winter in warmer places. However, just like many people, numerous birds consider California a highly desirable place to spend their winter vacations.

Here in the Bay Area, especially in open and natural areas such as Mount Diablo, Del Valle Reservoir and our very own Site 300, we are graced with the presence of several interesting winter migrants that arrive from the Arctic, Canada and the Northern and Midwestern states during late fall. Perhaps most notable among these winter visitors are raptors (birds of prey such as hawks, owls and eagles).

California boasts one of the highest numbers and types of wintering raptors in North America, trumped only by Texas and Florida. Among the raptors that visit the Tri-Valley region only during the winter are ferruginous hawks (*Buteo regalis*) and rough-legged hawks (*Buteo lagopus*). Both species inhabit grassland habitats; undoubtedly, this is why they are attracted to Livermore and Site 300.

Rough-legged hawks are so named because their feathered legs make them look like they're wearing legwarmers. The closely related ferruginous hawks share this unusual feature, which is an adaptation to living in cold climates. Most other raptors, and in fact most birds, have bare lower legs, with feathers only on their thighs. Both ferruginous and rough-legged hawks are generally streaky, with a mix of cinnamon brown to dark brown and white feathers. These hawks are quite large, with wingspans of 4-5 feet and sleek bodies that are nearly 2 feet long. Hawks are skillful hunters and seek out and eat small mammals like mice, voles, rats, ground squirrels and sometimes even feast on small birds or rabbits found in our rolling grasslands. Their regally hooked beaks and heavy talons give them all the hunting tools required beyond their strong wings and sharp eyesight.

The ferruginous hawk is quite a committed bird, as it forms long-lasting monogamous relationships. One pair nested together for 28 years, raising 66 ferruginous hawk fledglings during 19 of those years. Ferruginous hawks breed as far away as Canada, and winter in the Western states and in Mexico.

On the other hand, rough-legged hawks



By Jennifer Garrison

are quite the worldly travelers, breeding even farther afield in Alaska, the Canadian Arctic and northern Eurasia. Like many young travelers, rough-legged hawks often meet their mates while on their winter holidays. If you are lucky, you may witness a male

rough-legged hawk performing a soaring sky dance as he tries to court his favorite feathery female. He closes his wings, swoops down and climbs back up, stalls, and then swoops down again to repeat his hopeful dance. While rough-legged hawks do pair up monogamously to raise young, it seems this commitment may not last past that season. So goes the fickle nature of young love.

Many other raptors have made California and our LLNL sites their permanent home. A unique raptor here on the main campus is the white-tailed kite. You may spot the kites and their young in nests at the top of large trees on the northern edge of campus during the summer months. This winter, take a moment to look to the skies and you may spot golden eagles, turkey vultures, red-tailed hawks, Cooper's hawks, American kestrels and even perhaps a bald eagle.



During the winter months, Site 300 bird watchers may spy several interesting migrants, including the adult kite (top right) and kite babies (above). The ferruginous hawk (center) and the rough-legged hawk (right) can be detected by their mix of light and dark brown and white feathers. These hawks have a large wingspan of 4-5 feet, as displayed by Lab biologist Michael van Hattem.

Photos by Michael van Hattem and Pete Bloom



Birding 101: winging it in the Bay Area

Have you ever wandered over to the Central Cafeteria for some midday refueling and wondered, "What was that interesting looking bird wading along the banks of the basin?"

Or perhaps you have been hard at work in your office when the high pitched song of a visiting passerine left you hopelessly distracted, asking "What kind of bird is that and when is it going to stop singing?" Well, satisfy your curiosity and take a virtual birding excursion around the basin for Birding 101: Avian Identification.

Our journey begins along the basin's southern banks on a cool and misty December morning when we spy a large, graceful predator slowly wading through the shallows. His pace is purposeful, taking one step every 3-5 seconds so as not to alert anyone of his presence.

Suddenly, in a blink of an eye, he thrusts his spear-like bill into the cold water and captures the first course of his fish breakfast. After quickly consuming his tasty prey, this avian visitor realizes he is being watched and with long, slow wing beats he uses his six-foot wingspan to lift himself from a productive fishing hole and casually glide to the next one.

After noting this bird's foraging behavior, flight pattern, and size, we determine that it's some type of heron (Family *Ardeidae*). Now we must use our field guides and visual acuity to identify the species. As we stealthily watch the heron, the puzzle pieces slowly fall into place.

One person calls out, "I see a white face, and dagger-like yellow bill with a black tip; he also has a broad, black eyestripe that extends off the head." Another person adds, "His body is primarily a blue-gray color; he's got a black shoulder patch and long yellow legs." Congratulations. You have just successfully identified your first Great Blue Heron (*Ardea herodias*), a sporadic visitor to LLNL.

Our birding journey continues along the basin's west bank during a mild, sunny February afternoon



By Brian Spirou



© 2005 Joyce Gross



Michael G. Van Hatten



Jim Woollett



Top left: Black Phoebe (*Sayornis nigricans*), on a sally perch. Center left: The Pied-billed Grebe (*Podilymbus podiceps*) is a common visitor to the basin and an open water specialist. Pied-billed Grebes are strong swimmers and pursue prey by diving to catch aquatic invertebrates and small vertebrates. Lower left: The Green Heron (*Butorides virescens*) is a small wading bird that specializes in slow stocking off prey within the shallow water margins of the basin. Green Herons prey upon fish and aquatic invertebrates. Above: The Snowy Egret (*Egretta thula*) is a showy wading bird, that similar to its relatives pursues prey within the shallow margins of the basin. Egrets tend to be easily disturbed, so the best time to see one is either early in the morning or in the evening when the basin is calmer and the area has less foot traffic.

when a broken series of "tee-hee, tee-hoo's" are heard that peak at a high note and then drop in the second phase. Curious about what is making this sound, we patiently scan the shoreline and eventually notice a small bird sitting atop an exposed branch. The bird

swoops off its perch and embarks on a quick, circular flight path over the water and then perches again. Someone announces, "It's a flycatcher (Family *Tyrannidae*) hunting for insects." Yet, there are 36 flycatchers in the west, which one is it?

We notice that she is about six inches in size and, while perched, she bobs her tail. Black plumage covers her entire back and a slight tuft on her head. When she turns, her white belly and tail feathers are revealed — it's a Black Phoebe (*Sayornis nigricans*).

Despite this quick journey, avian identification is less daunting now. First, we simply make behavioral observations: foraging behavior, flight pattern, song, and unique characteristics like the Black Phoebe's tail bob.

When combined with observations of broad physical characteristics (e.g., size, shape), these serve to identify the family or subfamily for this bird, thus simplifying the avian identification process. Detailed physical characteristics (e.g., plumage coloration, beak shape) and other helpful considerations such as preferred habitat (is the bird typically seen in a woodland, marshland, etc.?) and residency status (When can one expect to see a certain bird in this part of California? Is it a migrant species?) then can be used to identify the species.

The next time you need a break, why not head over to the basin for a birding identification excursion. Or why not load up the family and share your newly acquired birding skills at one of the great parks listed below? Don't forget your binoculars (offsite only), field guide (try *National Geographic's Field Guide to the Birds of North America*), notebook and camera. Birding is a great way to spend a day together. And it gets kids fired up about science.

Want more bird identification information? Check out Cornell University's Website (<http://www.birds.cornell.edu/programs/AllAbout/BirdsBirdGuide/>) or contact summer intern Brian Spirou at spirou2@llnl.gov.

Great parks for birding

- Sycamore Grove Park (Livermore)
- Berkeley Aquatic Park (Berkeley)
- Coyote Hills Regional Park (Fremont)
- Don Edwards National Wildlife Refuge (Fremont)
- Tilden Park and Wildcat Canyon (Berkeley)
- Henry Coe State Park (Morgan Hill)
- Martin Luther King Jr. Regional Shoreline (Oakland)
- Big Basin State Park (San Mateo County)
- Golden Gate National Recreation Area (Sausalito)
- Point Reyes National Seashore (Marin)

Look for these other birds in, around the basin

Bufflehead (*Bucephala albeola*)
Pied-billed Grebe (*Podilymbus podiceps*)
Lesser Scaup (*Aythya affinis*)
Ruddy Duck (*Oxyura jamaicensis*)
American Coot (*Fulica americana*)

Killdeer (*Charadrius vociferus*)
Greater Yellowlegs (*Tringa melanoleuca*)
Green Heron (*Butorides virescens*)
Great Egret (*Ardea alba*)
Cattle Egret (*Bubulcus ibis*)

Tropical migrants return to Bay Area breeding grounds

Have you noticed any new bird songs or seen a flash of color outside your window in the morning lately? Spring marks the arrival of a whole new batch of birds in the Tri-Valley area.

Many birds spend their winters in Mexico or Central and South America. When North America warms up, these birds return here to breed. Some of these birds will take up residence in the Bay Area, while others merely pass through on their way north. Because of their habit of returning to the tropics every year, these birds are referred to as neotropical migrants. Some of the new arrivals, such as the MacGillivray's Warbler (*Oporornis tolmiei*) are secretive and hard to spot, while others, such as the Lazuli bunting (*Passerina amoena*) and Western tanager (*Piranga ludoviciana*) are surprisingly colorful.

Spring also marks the time of year when LLNL wildlife biologists begin to arrive at Site 300 before dawn to record both new avian arrivals and faithful year-round residents. Every other week, LLNL biologists and trained volunteers set up mistnets at Site 300 to conduct an ongoing study of bird populations. These 42-foot-long nets are stretched between two poles about three feet above the ground. Birds cannot see the black web-like mesh, fly into the nets, and gently fall into a net pocket; biologists then remove these birds unharmed.

Mistnetting occurs in the morning hours, when birds are most active, and continues until around noon. Mistnets are used because they allow an up-close view of the bird. This is important because close inspection of bird feather molt, coloration and wear is often the only way to determine sex and age.



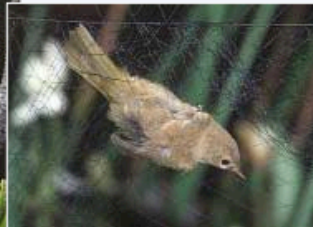
By Jennifer Garrison



PHOTO © 1999 DON GETTY

Birds in the area include the Lazuli bunting, top left, which is shown at the Elk Ravine banding station at Site 300. Another recent arrival is the Western tanager, center. Top

right, the Common Yellowthroat has flown into a mistnet, which allows for an up-close view of birds without harming them. Lower right, Laboratory biologists inspect a Willow Flycatcher at the Site 300 bird banding station.



MICHAEL VAN HATTEM



MICHAEL VAN HATTEM

location. A tiny and light metal band, stamped with an individual number provided by the U.S. Geological Survey's Bird Banding Laboratory (BBL), is carefully put on one of the bird's legs. This band, which does not harm the bird, allows biologists to track birds' movements over time, if the banded bird is found again in a mistnet at Site 300 or elsewhere. The newly banded birds are then released and fly back into the trees and grasslands of Site 300.

This program allows LLNL biologists to determine the diversity of birds at Site 300, identify which birds reside here year-round and which just pass through on their annual migratory flights.

Such information enables LLNL to protect sensitive species and plan projects accordingly, lowering the overall environmental and economic impact.

The Site 300 banding station is part of a large nationwide study called the Monitoring Avian Productivity and Survivorship (MAPS) Program (<http://www.birdpop.org/maps.htm>).

MAPS, run by the Institute for Bird Populations in Point Reyes, compiles information on bird species distribution, abundance and breeding status nationwide to better enable us to understand our nation's bird diversity and distribution, and to recognize declining species so they may be protected before they are threatened with extinction.

The Lab runs the only banding station in the Altamont region and thus provides much-needed information on bird diversity in the area. The Lab banding station, along with several sitewide visual bird surveys, has revealed that there are more than 120 bird species living in

or passing through Site 300. Several species previously unknown in the region (such as the Willow Flycatcher) have been caught during these mist-netting sessions, providing much-needed information on the distribution of these rare species.

Small mammals are ecological giants in local grasslands

Despise or adore them, local burrowing mammals are receiving more attention as "big players" for their contribution to the overall well being of California's ecological communities.

Ecological communities are defined as a group of interacting species living in the same place. A community is linked by the network of influences that species have on one another, great or small. One species may affect another one or numerous others in its ecological role. This concept has become popularized by the term, "the balance of nature," and speaks to the complexity of levels of interaction that are occurring in any given community at any given time.

Common yet a keystone species

California ground squirrels (*Spermophilus beecheyi*) are being investigated as a "keystone species" for the California prairie ecosystem. This is a species whose presence or absence, or significant increase or decrease in population size, profoundly affects other species' survivability in that habitat. Recognition of this ecological standing is usually derived from the results of studies in which the species is added or removed from the community.

The term "keystone species" comes from the center stone in a Roman arch that supports the majority of the structure's weight. Removal of this keystone causes the entire form to collapse. In this way, removal of a keystone species can lead to the local extirpation of many species and negative effects on the overall health of the ecosystem.

Why are ground squirrels of heightened interest to ecologists? More than 200 other wildlife species have been sighted using ground squirrel colonies. Some species prey upon ground squirrels while others use their burrows for shelter. In Central California, common wildlife visitors to areas of ground squirrel occupation include red-tailed hawks, coyotes, golden eagles, northern Pacific rattlesnakes, and burrowing owls. Also, a long list of insects and plant species

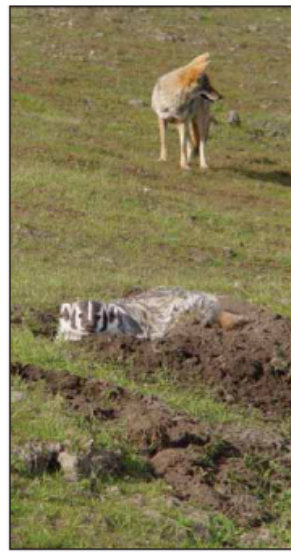
are associated with the colony's construction area.

Additionally, squirrel feeding activities result in a tilling or churning of the soil, enhancing its ability to support plants. A greater vegetative diversity – with nitrogen-rich mixtures of grasses and forbs – offers sustenance to other animals. This enriched habitat attracts a wide array of grazers and browsers that wish to utilize these food resources. Ecologically heralded as the food web hierarchy, this diverse association of plants and wildlife is dependent on the squirrel's presence for life.

American badgers

Another subterranean species that is gaining notoriety as an ecosystem giant in the California's grassland prairie is the American badger (*Taxidea taxus*). Although not receiving the accolades of the keystone species, the badger is a close runner-up as an "ecosystem engineer." This term denotes an organism that creates or modifies the physical environment in a significant way over time. Beavers (*Castor canadensis*) are the stereotypical ecosystem engineer because of the effects their dams have on stream flow, geomorphology, and the surrounding ecology and life forms that use the region.

Badgers also do their share of native engineering by modifying the landscape and soil nutritive richness. By loosening and aerating the soil, they speed up the decomposition of vegetation, enhancing nutrient availability. During wildland fires, these soils can serve as firebreaks for down-hole escapees. Since badgers were part of the ecological setting before humans, they may ultimately be connected to the presence and restoration of native plant species and their seed banks. The large soil excavation mounds at the



ROS ARGAMBRIGHT/SMED

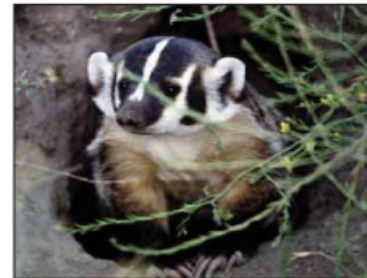
entrance of badger dens result in the mixing of nutrients and soil conditions as deep soil is brought to the surface. Badger burrows can act as homesteads to other wildlife species including rabbits, salamanders, frogs, snakes and long-tailed weasels, especially during the hot summer months. Badgers have been known to work "collaboratively" with hawks and coyotes to raid pocket gopher and squirrel holes (see inset photo).

Regardless of the colorful scientific moniker used to identify these species and their ecological roles, current research suggests that these two California underground inhabitants play a bigger role in shaping the natural environment than was previously believed.



JIM WOOLLETT/EPD

Badgers (left and below) are prairie ecosystem engineers. The ground squirrel (above) also plays an important role in the food web hierarchy.



Security Department to close Avenue B security post today

The Lab's Security Department has announced that security post 3B, on the north side of the intersection of Avenue B and Third Street, will close permanently beginning 6 p.m. today (March 3) —except for Fire Department emergency vehicle traffic. The closure is one of several cost-driven service reductions needed to meet the department's FY 2006 budget reductions.

Within approximately one block of pPost 3B, three alternate access points for use by pedestrians and bicyclists who must travel northbound or southbound in that area. The access booths are long enough to accommodate a bicycle and rider who has dismounted.

Adjacent to each booth is either an electronic or manual turnstile for pedestrian access only. The electronic turnstile

allows passage in either direction; the manual turnstile permits passage only from the Limited Area (LA) to the Property Protection Area (PPA). Employees who encounter problems with either the electronic access booths or turnstiles should call the PPD Alarms Console at 2-7222 to report malfunctions.

The post 3B closure means that approved motor vehicles must use an alternate entry point when traveling between the LA and PPA. Alternate vehicle entry/exit points are security post 1D, at the east end of First Street, north of Bldg. 316; and post west gate (P-WG), at the west end of First Street, northwest of Bldg. 111. Post 1D is open all hours every day. P-WG is open 6:30 a.m.-6:30 p.m., Monday-Friday, and closed on weekends and holidays.

Mountain lions are part of Tri-Valley environment

One early spring morning in 1999, a mountain lion was discovered within the fenced perimeter of the Laboratory. Around 7 a.m., as the early commute traffic began to file into the Laboratory, the cat made a determined move to leave the property along the west perimeter. This attempt placed the cat between Bldg. 132 north and the cross traffic on Mesquite Way. The lion followed its instincts that morning...

A similar story could have occurred in a multitude of places across the western states. More than half of the state of California is considered mountain lion habitat.

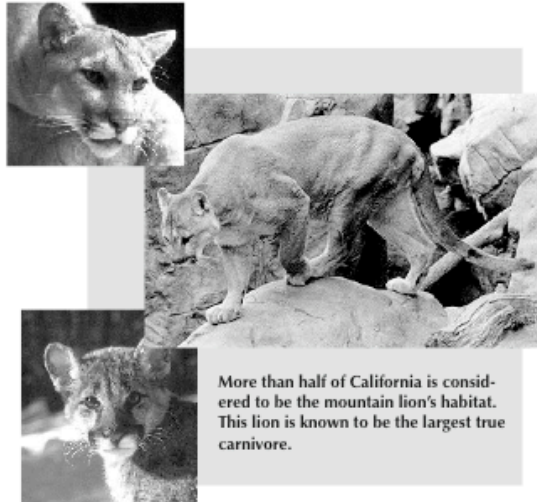
Known as the largest true carnivore in the Golden State, and known in scientific circles as *Felis* or *Puma concolor*, this cat can weigh and measure in length as much as an average man. Its geographic range is two-pronged in shape. One prong extends along the coast from the Oregon border to Los Angeles; the other extends from the northern edge of the Sierras south to the Mexican border and beyond. This is an animal built for moving long distances, and can traverse 20 miles overnight if required. Male lions may have a home range of 100 square miles and the females' range is generally half that size. Numerous females may reside within one male lion's territory.

Historically, lions could afford to live in remote areas and subsist on the deer herds within their territory. Today, most Coastal and foothill areas of California are far from the remote settings of yesteryear. The deer numbers have diminished, and people/cat conflicts are on the rise. This trend should be expected to continue. Lions naturally want to avoid people and their elusive behavior demonstrates this predisposition. Yet, given the ever more developed landscape, mountain lions have fewer escape routes available to evade human encounters.

A scientific study by Professor Paul Beier (formerly of UC Berkeley) found that mountain lion attacks on humans have been exceedingly rare. In the U.S. and Canada from 1890 to 1990, only 10 human deaths were attributed to such attacks. The California Department of Fish and Game has carefully documented encounters



By Jim Woollett



More than half of California is considered to be the mountain lion's habitat. This lion is known to be the largest true carnivore.

within the state and less than 16 injuries have been recorded during the last century.

Although prior to 1963, the State of California offered a bounty for each mountain lion killed in the state, the mountain lion is currently a "specially protected species" in California. Under California law it is only legal to harm or kill mountain lions in certain situations.

"The Department of Fish and Game may remove or take any mountain lion, or authorize an appropriate local agency with public safety responsibility to remove or take any mountain lion, that is perceived to be an imminent threat to public health or safety." The law also allows an individual, whose "livestock or other property" that has been damaged or destroyed by a lion, to report the incident to Fish and Game and obtain a permit to dispatch the offending animal.

Mountain lions are formidable neighbors if encountered. What is the smart rule of thumb for a human that lives or works in cat country? Know the local food source. Assume lions are in your neighborhood if deer herds exist nearby. Follow the conduct guidance outlined by the state Fish and Game when you are enjoying the outdoors in mountain lion range. And know how to identify a lion if you see a cat.

What happened to that mountain lion sighted at LLNL in 1999?

With an advancing workforce arriving onsite that morning, the lion sought cover under the closest and only bush within several hundred yards and did not move for the next fourteen hours. At 9 p.m. that night, the animal moved offsite and was not seen again for some time. Of additional note, a smaller and younger lion, suffering from malnutrition, was euthanized a week later only a few miles to the south of LLNL.

California Department of Fish and Game estimates between 5,000-6,000 lions exist in the state today. Whether you are driving to work or enjoying the outdoors, recognize that you are sharing space with a powerfully independent animal; in this case, the mountain lion. And take the necessary precautions to protect yourself and your family. See this Website (<http://www.dfg.ca.gov/news/news04/04009.html>) for the rules of conduct that the Department of Fish and Game suggest are followed in mountain lion areas.

In light of the recent lion attacks in Southern California and the repeated mountain lion sightings at Sandia National Laboratory, it is critical that people be aware of their surroundings and that mountain lions may be present. As suggested in this article, mountain lions can be found in urban areas as well as wilderness areas.

LLNL/Sandia security and wildlife biologists strongly suggest that Lab employees avoid walking or jogging at Sandia until the situation is determined to be safe. Updates on lion sightings will continue to be posted in *Newsline* and/or *News Online*. Please report observations (location, time, activity level) of mountain lions to LLNL's wildlife biology program at "4-WILD" and Sandia Security at 294-2300.

Majestic oak has deep roots throughout Valley

The majestic oak tree is an ancient symbol recognized by many cultures. The Celts, the Nordic and Germanic tribes, and the ancient Greeks, to name a few, all revered the oak tree for its physical qualities of strength, size and longevity.

California is fortunate to have many examples of this time-honored symbol. Nineteen native oak trees occur statewide and grow in a wide variety of sizes, shapes and landscapes. Two distinct groups are identified within the state: the white oaks with a light-colored wood and rounded (lobed) leaf pattern and red oak species with reddish-brown wood and bristled leaves. Areas with more than 10 percent oak canopy cover are considered oak woodland regions. More than four-fifths of California's oak woodland habitats are privately owned forests.

Blue oaks (*Quercus douglasii*) are a specific (white oak) tree species representative of the hot inland foothills of the coast ranges and the Sierra Nevada and also can be observed at Site 300 and around the Livermore Valley. This tree is typically the most visible oak tree in this area, but few people know its fascinating life story. Blue oak woodlands are present in the western foothills of the Sierra Nevada, the Tehachapi mountains, and in the eastern foothills of the coast ranges. The distribution of this species forms a narrow, nearly continuous ring around the Central Valley.

Life as an oak

Blue oaks are aptly named for the distinct bluish tint of their leaves. This leaf color relates directly to a protective, waxy covering that reflects the most damaging rays of the sun. These trees have an unusual tolerance that allows them to survive severe drought by, for example, shedding leaves if conditions become extremely dry. The density of blue oaks on hillsides has been directly linked to water availability or stress.

Blue oaks are considered a long-lived and slow-growing tree species. Old growth blue oaks in the coast range and Livermore Valley are between 100- to 400-years-old. Blue oak stands can be considered one of the most extensive old-growth forest types left in California. Studies within the past 50 years have noted that blue oak saplings are largely absent in current woodland habitats. Theories abound as to why so few young trees are surviving. Unfortunately, few answers are forthcoming and the larger question now is whether future conditions will allow for the persistence of blue oak woodlands.

Trees normally grow to 25 meters (82 feet) in height during their lifespan. The largest tree found in Alameda County measures a massive



By Jim Woollett



Blue oaks are a specific (white oak) tree species found at Site 300 and in the Livermore Valley.

28.7 meters (94 feet) in height with a crown of 14.6 meters (48 feet). The understory vegetation common to blue oak woodlands is composed primarily of annual grassland.

Biological setting

Oak woodlands play a critical role in determining the presence of native species of plants and animals and their distribution. For instance, more than 2,000 plants, 5,000 insects, 80 amphibians and reptiles, 160 birds, and 80 mammals occupy oak woodland areas. These oak communities and their extensive root systems also serve to protect water quality by preventing soil erosion and the effects of stream sedimentation. Acorns provide an abundant fall food source for many species of wildlife and tree cavities serve as shelter and nest sites for others.

Sudden Oak Death (*Phytophthora ramorum*) is a recent disease of unknown origin that has been detrimental to oak species in the state. Researchers suspect it originated in Asia and entered the United States on plants imported for horticultural use. Sudden Oak Death is now established in 14 counties in California and more than 40 species of trees, shrubs and herbs are susceptible to the disease. More than one million trees in California have died in the last decade and millions are believed to be at risk along the Pacific Coast.

Protection efforts

Oak woodlands are now a regulated arboreal resource within many local jurisdictions of California. State, county and city governments have passed laws and ordinances that require adequate protection of woodland areas and promote long-term stewardship of these areas through such actions as conservation easements, oak plantings and designation of "heritage trees."

Today, the single greatest threat to oak woodlands results from human-driven residential, industrial and commercial development. Woodland

conversion as a result of agricultural practices like orchard planting and vineyard development also contributes to regional losses.

An Old World belief suggests that by catching a falling oak leaf, a person can avoid sickness the entire winter. A good reason to find your closest blue oak tree, don't you think?

FIRST STD
U.S. POSTAGE
PAID
LIVERMORE, CA
94551-0808

Newsline

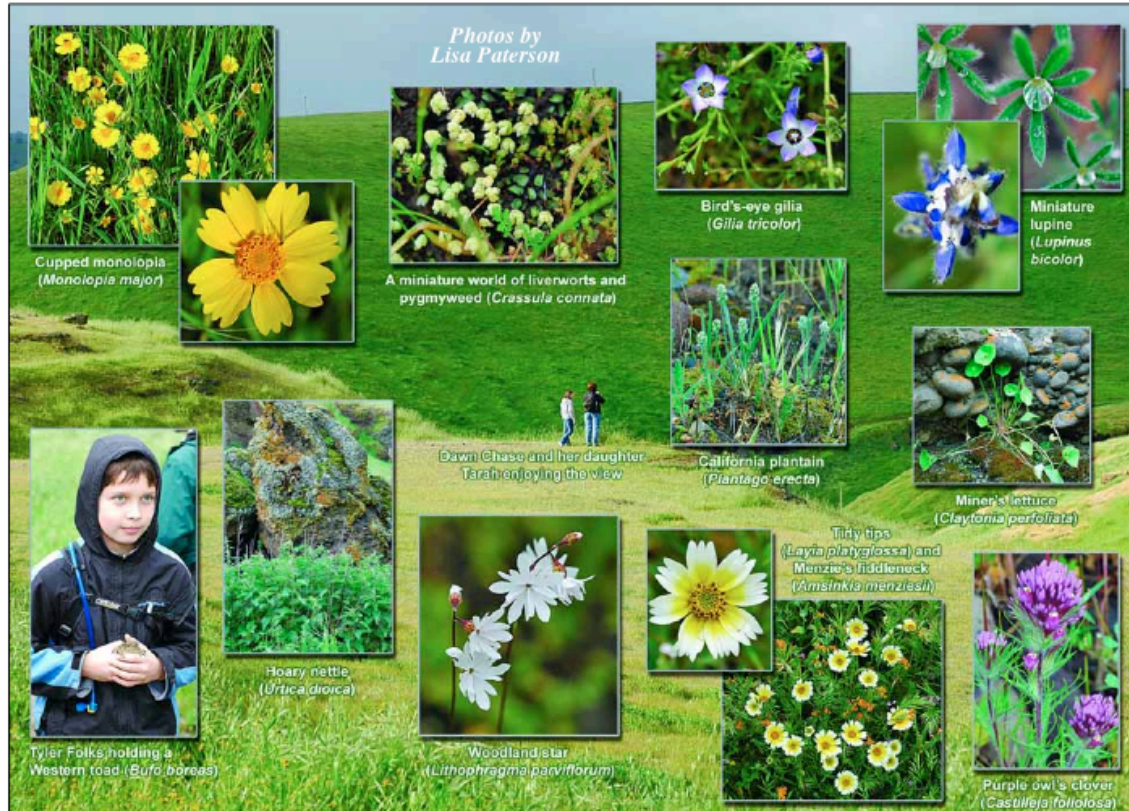
LLNL

PO Box 808, L-797

Livermore, CA 94551-0808



Site 300 annual spring photo safari



Site 300 management has a tradition of hosting a Photo Safari each spring. The Photo Safari is open to the staff of Site 300 and their guests. Participants have the rare opportunity to hike in some of the remote canyons of Site 300 and photograph the beautiful natural environment found in these areas. This year, early on a rainy Saturday morning, the Photo Safari group was led by Jim Lane, Site 300's manager, through Elk Ravine and its tributary canyons (located in the eastern portion of Site 300).

Site 300's autumnal splendor

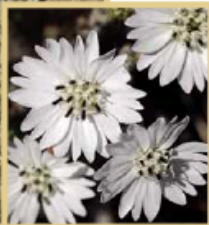
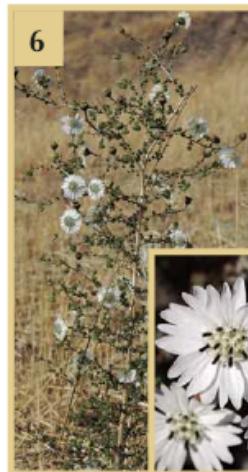
Although the hills appear to be covered in a monoculture of brown grass at this time of year, if you take a closer look, you will find several California native forbs blooming and thriving in late summer and early fall. These species are amazing in their beauty and their ability to survive and even flower during the hottest, driest part of the year.

Several of these late season flowering plants are in the sunflower,



mint and buckwheat families and have adaptations that allow them to survive our hot dry summers such as extensive root systems that are able to use what

little moisture is available in the soil. These plants limit the amount of water lost through their leaves by having small leaves (tarweed and spikeweed) or leaves that are very waxy (gum plant) or hairy (vinegar weed and buckwheats). Many buckwheats also have leaves that are rolled in at the edges to limit water loss. Look for these hardy beauties at Site 300 and in our nearby hills.



1) Wright's buckwheat (*Eriogonum wrightii*), BUCKWHEAT FAMILY; 2) angle-stemmed wild buckwheat (*Eriogonum angulosum*), BUCKWHEAT FAMILY; 3) vinegar weed (*Trichostema lanceolatum*), MINT FAMILY; 4) spikeweed (*Fernizonia pungens*), SUNFLOWER FAMILY; 5) California matchweed (*Gutierrezia californica*), SUNFLOWER FAMILY; 6) big tarplant (*Blapharizonia plumosa*), SUNFLOWER FAMILY; 7) gum plant (*Grindelia camporum*), SUNFLOWER FAMILY; 8) tar weed (*Holocarpha obconica*), SUNFLOWER FAMILY



Site 300 is an oasis for a rare native plant

If you visit Site 300 at this time of year, it's not difficult to find big tarplant (*Blepharizonia plumosa*) blooming along roadsides and in other "disturbed areas," such as areas graded for roadways or designated for prescribed burns. Big tarplant thrives in the harsh arid Site 300 environment.

Although fairly common at Site 300, big tarplant is an extremely rare plant included in the "California Native Plant Society's Inventory of Rare and Endangered Plants of California." Big tarplant may be limited to as few as three general areas outside of Site 300. Its range includes Alameda, Contra Costa, San Joaquin, Stanislaus and Solano counties, where it is found in dry grasslands at elevations less than 1,650 feet.

Late summer may seem like a strange time of the year to be discussing rare plants: temperatures are near 100 degrees, the hills are brown with dried grasses and Livermore Valley residents are starting to long for the first fall rains. But amazingly, big tarplant is one of many California native plants that have adapted to bloom in the hottest and driest part of the year. Big tarplant is a fall flowering annual plant. Similar to the rest of the native annual flora, its seeds germinate in the fall and winter with the first rains of the season. However, unlike the more widely known spring flowering annuals, big tarplant remains relatively inconspicuous until the very end of the summer when it blossoms and sets seeds just before the fall rains start the cycle again.

Big tarplant lives on moisture that remains in the soil after the spring flowering plants have dried and withered. It's hard to believe there is any water left in that dry, hard soil in August, but surprisingly there is. It is the same moisture that some of our noxious late-season weeds survive on, such as yellow star thistle.

Big tarplant has developed many strategies to survive in the conditions that exist at and around



STEVE GREGORY

Big tar plant (left) blooms late in the year in September and October when most Site 300 plant life is dried and dormant. It easily grows along the roadsides at Site 300



Site 300. This species is a member of the sunflower family (*Asteraceae*). As is common in many members of the sunflower family, tiny glands on the stems and leaves of big tarplant, give it a distinctive smell. The resin produced by these glands helps to deter herbivores such as insects and deer. Its inner seeds have tiny feather-like appendages, called pappus, which give each seed the appearance of a tiny helicopter and help them to disperse in the wind. The small hairy

leaves of the big tarplant help to limit the amount of water it loses through evaporation.

Research conducted by LLNL's Environmental Protection Department indicates that the annual prescribed burns conducted at Site 300 play a role in the abundance of this rare species at the site. Big tarplant grows in large numbers in areas that are routinely burned at Site 300. This is unusual because at the time of the annual spring burns, the plant is a small green seedling, and thus very susceptible to fire damage. Although fire is fatal to individual big tarplants directly in its path, fire may provide the disturbance necessary to reduce competition with other plant species (such as exotic annual grasses) and allow larger groups of big tarplant to be established.

It is possible that the larger Site 300 big tarplant population is acting as a group of smaller populations that are mostly isolated. Seeds are occasionally exchanged between the small populations so that if one is completely destroyed by fire it can be repopulated by seeds from another. This group of small populations is referred to as a metapopulation. Smaller groups of big tarplant may establish or disappear, depending on fire uniformity and intensity, but the metapopulation is sustained.

Although historic occurrences of big tarplant have been lost as a result of residential development and competition with non-native plants, it is perfectly adapted to the hot, dry, windy grasslands of the Altamont Hills and the cycle of wildfire that are a natural part of this environment (see the Aug. 20 Wild Side). Research continues at LLNL to determine how disturbance (prescribed burns, road grading) affects big tarplant. It is hoped that this research will help determine the management practices necessary to promote healthy populations of big tarplant both at Site 300 and throughout its historic range.

There's no reason to get rattled as snake season starts

The Northern Pacific rattlesnake is the only native venomous snake to Northern California. Some key traits of the reptile are aptly depicted through its scientific name. *Crotalidae* is derived from the Latin (*crotalum*) meaning "rattle." *Viridis* describes the green coloration that is a particular trait to the snake in this region. *Oreganus* refers to the location of the specimen that classifies the species throughout its range. The geographic range of the Northern Pacific rattlesnake reflects its namesake as well: Santa Barbara north through Oregon and Washington states.

Knowing how to handle an encounter with a rattlesnake is a good idea for those who work in dry, rugged areas like the Laboratory's Site 300 Experimental Test Site. But a cognitive understanding may also benefit people active outdoors in Livermore or other areas where suburbia abuts large areas of wild land. These snakes prefer dry, remote, rocky outcrop areas where they can den in the summer and sleep in the winter. A key item to remember is that rattlesnake populations are cyclical — during some years the numbers are higher and other years they are lower. So, observations and encounters may vary greatly over time. Below are two main aspects of snake ecology that, when taken to the field, should allow you to make an informed decision about the rattlesnake realm.

Recognizing the snake

As March approaches, and the seasonal changes cause an increase in sunshine and daily temperatures, it's a good idea to know how your activities outside may coincide with the rattlesnakes'. At the Laboratory, the Northern Pacific rattlesnake is most likely to be seen at Site 300, but can also be found in the rocky terrain of grassland habitats surrounding Livermore's main site. Understanding some key aspects of snake appearance and behavior may help you during an unexpected



By Jim Woollett



JEFF MILLER



Left, the Northern Pacific rattlesnake, also known as *Crotalus viridis oreganus*, is coiled and ready to strike. Above, a gopher snake is often mistaken for a rattlesnake at first glance.

meeting while you work in the field or walk along a local country road.

Identifying a rattlesnake is not always a simple task. From a distance, their beige colors and elongated shape are much like any other snake of the area. Contrary to popular belief, they rarely reach lengths of over 4 feet. Coloration can range from dark green on the back and yellowish on the belly to complexes of drab brown and tan tones. Dorsal patterns or "diamonds" across the back

are not a true identifier of a rattlesnake. Gopher snakes, the more common non-venomous compatriot of the California grasslands, have adopted very similar markings and will even buzz their tail to mimic their poisonous counterpart when alarmed, hoping you will mistake them for a rattlesnake and give them wide berth.

Three of the best physical descriptions of the Northern Pacific rattlesnake are the following:

- Rattlesnake tails transition into white and black rings at the base.
- Rattlesnakes have a wide and triangular-shaped head on a slender neck.
- At close range, rattlesnakes have a vertical pupil (much like the eye of their viper like ancestors).

Behavior of the snake

Rattlesnakes are definitely venomous, but if you live or work around them the snake often appears reclusive in nature. The majority of documented bites center around animals that are suddenly surprised or provoked. Many people have inadvertently walked on or over these snakes with no harmful consequence. Studies indicate that venom is used primarily for collection of prey. In fact, many members of the pit viper family have full control over how much venom is injected and from one or both of the fangs. It is not unusual for a person that was struck by rattlesnake to receive a "dry bite" whereby venom was not actually released. These snakes are primarily nocturnal and movement patterns during the day are generally related to an increase in appetite, local disturbances or breeding activities.

Keep a safe distance from any sunning snake and stay away from animals crossing roads that are coiled to strike. It's always a good idea to watch any snake from a distance. When hiking or working in the field, wear a boot with coverage extending above the ankle. See the Department of Fish and Game Website (www.dfg.ca.gov/news/news03/03054) for other advice on snake safety.

Ravens: Pondering a dark and mysterious bird of lore



By Jessie Coty

With Halloween just behind us and winter's early darkness setting in, it seems timely to highlight a dark creature steeped in literature and folklore. The raven is as cloaked in myth and mystery as it is in deep ebony plumage. Consider Edgar Allan Poe's poem "The Raven," in which the raven repeats the word "nevermore" or the Native American belief that the raven is a trickster or cheater, yet a god who created the earth, moon, sun and stars. Perhaps their dark silhouette along with their bold, gregarious nature makes them seem eerily associated with death and danger, and yet full of wisdom to many poets and authors. Their cultural significance is matched only by their ecological prevalence across the globe.

Background

The common raven (*Corvus corax*) is the largest of all passerines (songbirds) with wingspans reaching up to 3.8 feet (1.2 m), a length of just over two feet (69 cm), and weighing up to 3.6 pounds (1.625 g). Imagine 22-30 sparrows sitting together on a scale and that would equal the weight of one raven. It is not only the largest songbird, but it is also the most widespread bird globally, occurring across North America and Eurasia and southward into Central America and northern Africa. The common raven is widely regarded to be a very intelligent bird, if not the smartest; this makes it highly adaptable.

Conservation status

Although ravens may seem ubiquitous, by the early 1900's, this bird nearly disappeared from the northeastern U.S. Historically, ravens lived on the Great Plains in association with the American Bison (*Bison bison*) and wolves (*Canis lupus*). Shooting, poisons, baited traps and the disappearance of the bison all contributed to the ravens' near demise in the East. However, by the late 1990's, raven populations markedly increased in most areas, reclaiming many parts of their previous range. However, the raven remains eradicated in some states (e.g., Alabama, Indiana) and endangered (e.g., Tennessee) or threatened in others (e.g., Kentucky).

In the western U.S., the raven's remarkable capacity for adapting to diverse conditions allows it to use human-modified habitats; this has resulted in population increases of the ravens in the West. Across its wide



© 2007 STEPHEN DOWLAN

Note the raven's very heavy, chisel-like bill and the elongated throat feathers called hackles that differentiate a common raven from an American crow.

and diverse range (globally), an estimated 16,000,000 individuals currently exist.

Life history

As one of the largest birds in the Corvid family (jays, crows, and its allies), its size and glossy black plumage give the raven an eye-arresting and majestic appearance. It has relatively long, pointed wings, a wedge-shaped tail, elongated throat feathers called hackles and a large, heavy chisel-like bill. Males and females look alike except that females are slightly smaller.

The common raven inhabits every type of terrestrial habitat except rainforests; this includes forests, grasslands, deserts, and urban areas. Unique habitats are no exception. If tundra or arctic ice floes occurred in the California area, you'd see common ravens using them as they do elsewhere. In California, it may be found in most habitats.

Ravens tends to stay to themselves (solitary) or in a pair, but may gather in large groups for foraging or roosting; it's common to see groups of ravens soaring at Site 300. The raven is known as a scavenger (animal carcasses or garbage), but it's also a predator for a range of foods: arthropods (including scorpions), small mammals, amphibians, reptiles, and birds (eggs, nestlings, adults), as well as seeds and grains. Interestingly, the common raven stores extra food. This typically monogamous bird breeds and lays eggs from February to April, with clutch sizes of 3-7 eggs and with both parents tending the young. Rather than migrate, the raven is typically a year-round resident.

Among its unique characteristics, the common raven makes a wide array of sounds that result in an almost limitless sound variation. Calls may range from low, deep baritone croaks to high, bell-like and twanging notes and much in-between.

Unfortunately, it's also a bird that is listed as a

reason for the decline of other threatened and endangered species, such as the desert tortoise (*Gopherus agassizii*), California condor (*Gymnogyps californianus*), marbled murrelet (*Brachyramphus marmoratus*) and least tern (*Sterna antillarum*).

Is it a crow or a raven?

Common ravens are often confused with American crows (*Corvus brachyrhynchos*). Both are found in the same areas. Although the two species appear very similar, a couple of clues may help to differentiate the two. If you watch a raven fly, it displays aerial acrobatics, often somersaulting or rolling in the air. It will often soar (an interesting fact is that the common raven has been observed flying upside down for just over half a mile or one kilometer). Crows never soar, but rather smoothly and continually flap their wings. Although the size of a crow is smaller than that of a common raven, it may be difficult to distinguish unless they are near each other. Rather, look for the wedge-shaped tail of the raven, its much heavier bill, and its "hackles" (shaggy throat feathers).

At the Lab

The common raven prefers contoured landscapes or habitats with diverse elements, including the fence just outside my office window. Ravens may be found majestically soaring the thermals common to the Altamont's rugged hills, but they also adapt well to the Laboratory, scavenging around man-made structures for food and nest sites. Enjoy this mysterious bird that inhabits our world, both real and imagined.



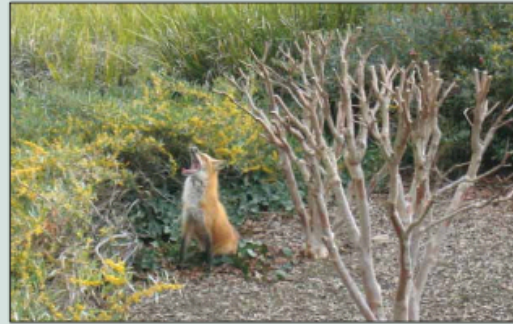
Newsline
LLNL
PO Box 808, L-797
Livermore, CA 94551-0808

Charismatic non-native fox highly adaptable outside of its range BY JESSIE COTY

This photo of a yawning red fox just stretching after a nap on the Lab's grounds is endearing. Yet, despite the charismatic nature of this ruddy-furred fellow, the red fox is an invasive non-native species in California's valley, lowland and coastal ecosystems. The red fox (*Vulpes vulpes*) became widely established after being introduced in California for fox hunting and fur farming.

While a mammal of only moderate size, the red fox is a stellar hunter and also excels at adapting to a wide range of habitats. Unsurprisingly, they are increasingly seen, like this Lab visitor, within suburban areas. Their omnivorous diet consists of small mammals (rabbits, rodents), water and ground-nesting birds, fruits, berries, insects and carrion. Garbage and pet food also are quite palatable; red fox will raid both. Establishment of the nonnative red fox in native species' habitats, results in greater competition and predation pressures on native species. As a result, native species' populations decline or are displaced. Numerous examples exist. Among these, piping plover nest destruction in Monterey, California clapper rail declines in the SF Bay National Wildlife refuge, and the displacement of the San Joaquin kit fox. LLNL wildlife biologists point to the red fox as a possible cause for the much diminished presence of burrowing owls in LLNL's north buffer zone.

While the red fox is certainly a charismatic and impressive species, and sightings are appealing, outside of its native range, this fellow is capable of great harm to native species and ecosystems. Please do not feed any wildlife on the LLNL site, including the red fox.



COREY CATE

The San Joaquin Kit Fox: Where are they?

By Laura Burkholder

The San Joaquin kit fox, a charismatic federally and state protected fox, is a native to this area yet presents wildlife biologists and other conservationists with a challenge in ensuring its recovery. This issue is quite relevant to the Lab and its community, as this area is both native habitat for this fox and is faced with balancing human development with species recovery. The federal recovery plan for this species recommends actions to encourage owners of large land tracts within the San Joaquin Valley to cooperate with recovery efforts. Due to the fragmentation of private and public lands in the Valley, voluntary cooperative management is seen as the only strategy that would significantly improve the overall habitat for the kit fox.

Distribution and Conservation

The San Joaquin kit fox inhabits grasslands and scrublands and was once widespread throughout most of the San Joaquin Valley. With the significant reduction and fragmentation of these habitats, the current range of the kit fox is largely reduced, and its distribution is sparse in the northern portion of its range, an area that includes Site 300. Although Site 300 provides highly suitable habitat and abundant ground squirrel prey for the kit fox, there are no known observations of this species onsite. However, historic populations may have occurred at Site 300. Prior to the 1930's the San Joaquin kit fox occurred in the San Joaquin Valley from Southern Kern County to eastern Contra Costa and Stanislaus County. By 1930, the kit fox range was reduced by more than half as a result of agricultural use, industry, and urban development. The largest remaining portions of its range occur in the southern and western parts of the San Joaquin Valley. Kit foxes are now very rare and have suffered significant population declines in other parts of their historic range.

The San Joaquin kit fox is listed as a federally endangered (1967) and state threatened (1971) species, providing it with federal and state protection under the Endangered Species Act. In addition to habitat encroachment and fragmentation, threats to kit foxes also include competition and predation from other species such as the red fox (nonnative), coyote, domestic dog, bobcat and large raptors.

Natural History

The San Joaquin kit fox is a small brown to grayish fox with long legs and large ears. It is the smallest member of the Canid family (dogs, wolves, and foxes) in North America, standing about 9 to 12 inches tall and weighing about 5 pounds.

These foxes are active year-round and are mostly nocturnal, but can be seen during the day. Kit foxes use dens for reproduction (pupping) and protection. They dig their own dens or modify burrows of other species like badgers, ground squirrels, and coyotes. They may also den in human-made structures such as culverts or drainpipes small enough to keep out coyotes. Active dens are often littered with prey remains, droppings,

or fresh tracks. One fox uses several dens throughout the year, which may be a method to avoid their predators.

Kit fox can breed at 1 year old. Mating occurs between December and March and litters of 2 to 6 pups are born about 48 to 52 days later. The pups begin to disperse from their parents in another 5 or 6 months in late summer. On occasion, one or more of the pups will stay with their parents through the year and help raise the next litter. Kit foxes in the southern portion of their range eat mostly kangaroo rats, pocket mice and other nocturnal rodents while those in the northern part eat primarily ground squirrels.

Kit fox at Site 300?

Is it possible that the small fox you briefly glimpsed flitting through the adjacent grasslands near Site 300 was a rare sighting of the San Joaquin kit fox? LLNL wildlife biologists have conducted surveys for this species at Site 300 since the early 1980's. In the 1980's and early 1990's kit foxes were observed in several areas near Site 300 including Carnegie New Town and the Altamont Pass area. The closest documented location was within 2 miles north of Site 300. Surveys conducted by LLNL wildlife biologists in the 1980's found several potential kit fox dens at Site 300, suggesting the occasional use of the site by kit foxes for denning and foraging, but providing no direct evidence. So while the San Joaquin kit fox has not been positively documented at Site 300, the potential for its occurrence onsite certainly exists. Because of low numbers, the kit fox can be difficult to detect in their northern range. LLNL wildlife biologists remain committed to protecting San Joaquin kit fox habitat and will continue searching for this unique species at Site 300, for the kit fox just may turn up onsite someday.

Tricolored Blackbird wings it at Lab's Site 300

The Tricolored Blackbird (*Agelaius tricolor*), a state and federal species of special concern, is a gregarious species, with more than 99 percent of its entire population found in the Central Valley, notably at Site 300.

These birds form huge breeding colonies in wetland, riparian and agricultural areas near favorable vegetation — such as bulrushes, willows, or barley — and ample water. When conditions are ideal, Tricolored Blackbird colonies have been known to get as large as 300,000 adult birds with 200,000 nests, though colonies of this magnitude have not been recorded since 1935.

These enormous colonies likely have disappeared due to the species' remarkable population decline.

The Tricolored Blackbird population was once more than one million birds strong. However, half of the population was lost between the mid-1930's and the mid-1970's, and it has continued to fall ever since. The reasons for the plummeting population are many, but chief among them are habitat loss and agricultural harvesting operations, which causes Tricoloreds' nests to be destroyed when the nesting habitat is harvested.

Although Tricolored Blackbirds continue to lose breeding sites through habitat alteration, there are protected areas and refuge opportunities for this species. Areas relatively free of human disturbance that contain proper vegetation and a nearby perennial water source can provide refuge to nesting Tricolored Blackbirds. State and federal lands in the Central Valley provide safe haven to the species, and organizations such as the Nature Conservancy fully compen-



By Brian Spirou



MICHAEL VAN HATTEM; INSET PHOTOS: BRIAN M. SMALL

Tricolored Blackbird adults are most easily confused with Red-winged Blackbirds. Tricoloreds are distinguishable by a squared tail (the tail is more rounded in the Red-winged blackbird), a longer and narrower bill than the Red-winged, and a narrower and more pointed wing shape. A minuscule portion of a Tricolored Blackbird colony is shown. Insert left: a male Tricolored. Insert right: a female Tricolored.

sate farmers who suspend harvesting operations in favor of Tricolored Blackbird breeding. Site 300 is one such breeding ground.

In June, a colony of about 1,000 nests was found in Site 300's Elk Ravine — representing the first Tricolored Blackbird colony detection at Site 300 since 2002. Tricoloreds typically occupy breeding sites on a three-year cycle, thus the detection of a colony in 2006 in Elk Ravine, while a year late, was expected. A recently completed restoration project has increased the habitat suitability of Elk Ravine, and the current year's colony was estimated to be 15 percent larger than the colony seen in 2002.

During the fall of 2005, a riparian habitat restoration project was completed in Elk Ravine. This project involved the construction of deep stream pools, which ensured availability of perennially present water near the breeding site. With ample water now available throughout the breeding season, the cyclical Elk Ravine Tricolored colony may continue to grow, thus contributing to the overall population recovery of the species.

With similar wetland/riparian restoration projects underway throughout the Central Valley, the Tricolored Blackbird has a better chance of making population gains. If these gains occur, Site 300 will not only have aided the species in its recovery, but it will have done so while demonstrating that conservation efforts can co-exist with technological and economic progress.

Brian Spirou is a biology team intern in the Environmental Evaluations Group. Contact him at spirou2@llnl.gov.

REFERENCE: BEEDY, E. C., AND W. J. HAMILTON III. 1999. TRICOLOR BLACKBIRD (*AGELAIUS TRICOLOR*). IN THE BIRDS OF NORTH AMERICA, No. 423 (A. POOLE AND F. GILL, EDS.). THE BIRDS OF NORTH AMERICA, INC., PHILADELPHIA, PA.

LLNL'S WILDSIDE



By Karen Jensen

The secret life of the Valley Elderberry Longhorn Beetle

It is a warm spring day. The elderberries (*Sambucus sp.*) along a stream sway with the breeze. One of these shrubs has a few small holes in its trunk, each one about the diameter of a pencil. Out of one of these holes crawls a beautiful, red and black beetle with long antennae. It takes a look around, cleans its antennae, and then crawls away to nibble on some fresh, green elderberry leaves. This is a newly emerged adult valley elderberry longhorn beetle (*Desmoceros californicus dimorphus*), otherwise known as the VELB.

Until recently, the VELB was only known from riparian areas that include elderberries (Figure 1) as a component from California's Central Valley. In 1980, the VELB was federally listed as a threatened species under the Endangered Species Act, due to the loss and alteration of its riparian habitat and because it naturally occurs at low population densities. More than 90 percent of riparian habitat in the Central Valley has been lost to agricultural and urban development. The remaining habitat is fragmented.

The VELB is a member of the longhorn beetle family (*Cerambycidae*). Adults are about 3/4 inch (2 centimeters) in length. Females are larger than their male counterparts, but males have longer and more robust antennae (Figure 2). Both sexes usually have a bright red color on their wings. The forewings of females are dark metallic green with bright red trimmings. In males, the forewings can be similar in color to the female's, or red and black with dark green spots.

The life history characteristics of the VELB are somewhat secretive and little known. However, it is assumed theirs is similar to the life histories of other closely related longhorn beetles. Adult VELB live for several weeks between the months of March and June, timed with the flowering of the elderberry plants. They dine on the leaves and possibly the flowers of the elderberry until it is time to mate. Females will deposit their fertilized eggs (Figure 3) in crevices of the elderberry bark. Eggs hatch a few days later and the larvae (Figure 4) bore into the pith of the plant's trunk, stem or roots.

The larvae complete their development in one to two years, all the while remaining inside the trunk, large branches, or roots of the elderberry



Background: An elderberry, host plant for the VELB. Credit: Karen Jensen
Inset, from left:

An adult male VELB. Credit: Richard Arnold

A deposited VELB egg. Credit: U.S. Forest Service

A VELB larva moving through an elderberry branch. Credit: U.S. Forest Service

VELB pupae undergoing waiting for metamorphosis. Credit: U.S. Forest Service

plant. They subsist on the pith of the elderberry during this period. At the end of this stage, the larvae chew an exit hole in the trunk of the host plant. Sealing the hole with a mixture of wood shavings and beetle droppings called frass, they retreat into the plant where they pupate (Figure 5) and go through metamorphosis. Once metamorphosis is complete, the adult emerges through the exit hole to start life on the outside.

Since most of VELB's life occurs within the elderberry plant, surveys for them tend to focus on searching for elderberries, the exit holes on the trunks, along with searches for adult VELB. During a 2002 survey at Site 300, six adult VELB and 16 exit holes were observed and recorded. Though the numbers may seem small, this information represents a range extension for the VELB, heightening this population's importance to the species recovery especially in the context of California's continued development and altering of riparian areas.



Newsline
UC-LLNL
PO Box 808, L-797
Livermore, CA 94551-0808

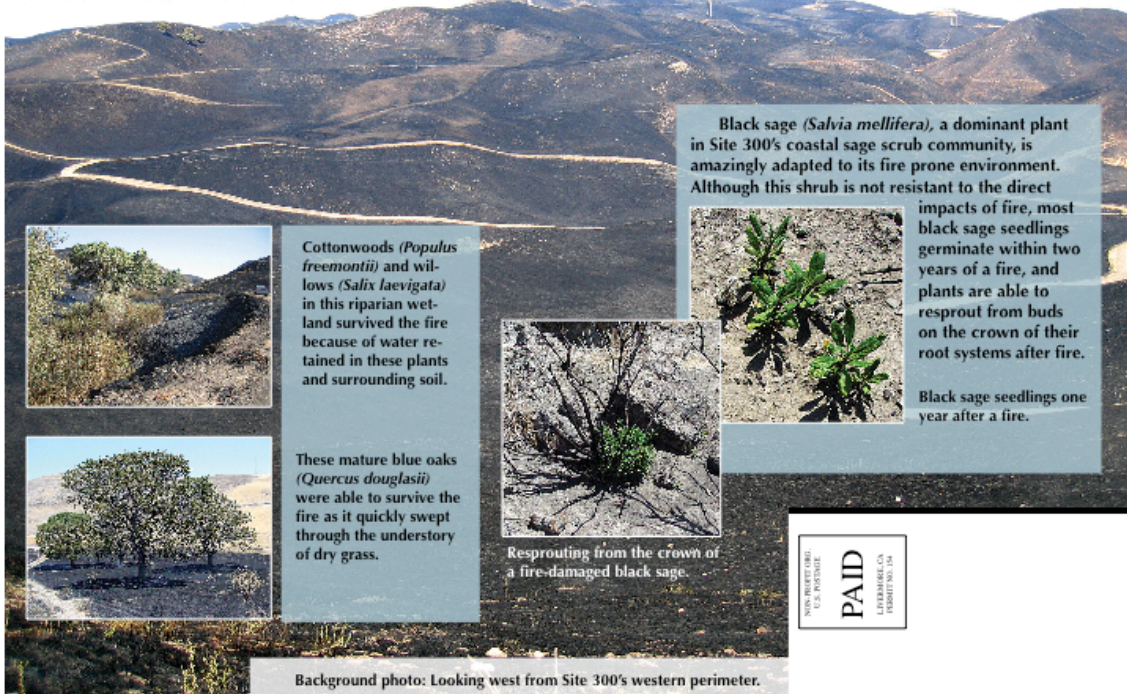
New life sprouting at Site 300 after the 2005 Tesla fire



By Lisa Paterson

Two years ago on July 19, 2005, a wildfire started in the dry grass at the summit of Corral Hollow Road between Livermore and Tracy. Strong winds caused the fire to spread quickly, and by the time the fire was controlled the following day, 6,387 acres had burned. The fire swept through more than 2,000 acres of undeveloped grasslands, coastal sage scrub and blue oak woodlands at Site 300. Each of these communities has evolved strategies that help them recover following wildfires.

Grasslands at Site 300 benefit from periodic fire because fire adds nutrients to the soil and removes old accumulated organic matter that restricts the germination of native seeds. Just one year after the wildfire, Site 300's grasslands had recovered from the effects of the burn. Site 300's coastal sage scrub communities had the largest impact from the 2005 fire. Although shrub species in this community have several adaptations that help them to recolonize burned areas, these species are susceptible to direct impacts from fire. Because the growth of shrubs is very slow in Site 300's arid climate, the impacts of the Tesla fire are still obvious in the Site 300 coastal sage communities two years after the fire.



Black sage (*Salvia mellifera*), a dominant plant in Site 300's coastal sage scrub community, is amazingly adapted to its fire prone environment. Although this shrub is not resistant to the direct

impacts of fire, most black sage seedlings germinate within two years of a fire, and plants are able to resprout from buds on the crown of their root systems after fire.

Black sage seedlings one year after a fire.



Cottonwoods (*Populus fremontii*) and willows (*Salix laevigata*) in this riparian wetland survived the fire because of water retained in these plants and surrounding soil.



These mature blue oaks (*Quercus douglasii*) were able to survive the fire as it quickly swept through the understory of dry grass.



Resprouting from the crown of a fire-damaged black sage.



Background photo: Looking west from Site 300's western perimeter.



May 2005: Two months before the Tesla fire, dense coastal sage scrub vegetation covered this hillside at Site 300.



May 2006: Coastal sage scrub species and ancient California junipers lost in the wildfire began to recover.



May 2007: Two years after the fire shrubby vegetation has started to recover.

Newsline
UC-LLNL
PO Box 808, L-797
Livermore, CA 94551-0808

Protecting arroyos vital to healthy area watershed



LLNL's wild side

By Lisa Paterson

A watershed is an area of land in which all water drains to the same location. LLNL's Livermore site is within the Alameda Creek watershed; two creeks cross the Livermore site (Arroyo Las Positas and Arroyo Seco) that are part of the network of waterways that form this watershed.

The Laboratory also pumps drinking water from the Hetch Hetchy aqueduct close to where the aqueduct crosses Arroyo Mocho, another tributary to the Alameda Creek watershed.

The Alameda Creek watershed includes an area of approximately 700 square miles in Alameda, Santa Clara and Contra Costa counties. Water in creeks and other drainages within this watershed accumulates and flow toward Alameda Creek and the Alameda County Flood Control Channel and eventually into the South San Francisco Bay near the Dumbarton Bridge.

The Alameda Creek watershed once supported populations of anadromous fish including steelhead (*Oncorhynchus mykiss*) and pacific lamprey (*Lampetra tridentata*). Anadromous fish spend the majority of their life cycle in the ocean and return to fresh water streams and rivers to reproduce. Steelhead historically spawned in Alameda Creek and its tributaries, and the young fish returned to the ocean via the San Francisco Bay after approximately one year in the fresh water streams. But by the 1950s, the California Department of Fish and Game considered the steelhead fishery no longer viable.

The largest barriers to fish migration in the lower Alameda Creek watershed include three inflatable dams and a concrete drop structure (known as the BART weir) located in the Alameda Creek Flood Control Channel near the San Francisco Bay. The most significant barriers to fish migration in the watershed's upstream reaches are the three dams constructed to create Calaveras, San Antonio and Del Valle reservoirs. Also, numerous smaller fish migration barriers exist throughout the watershed. A study completed by the Alameda Creek Fisheries Restoration Workgroup in 2000 concluded that sufficient steelhead rearing and migration habitat remains in the watershed to support a population of these fish if the migration barriers were removed.

Efforts have been under way by government agencies and citizens groups for more than 20 years to restore anadromous fish to the Alameda Creek watershed. The efforts of these groups are finally coming to fruition. In 2001, the East Bay Regional Park District removed two small swim dams from Alameda Creek in the Sunol Regional Wilderness Park. Recently, the Alameda County Water District was awarded two \$500,000 grants from the National Fish and Wildlife Foundation to remove the lower inflatable rubber dam in the Alameda Creek Flood



The Alameda Creek Watershed, in relation to the Laboratory site and its pumping station.

Control Channel and to install fish screens on water supply diversion points at the mouth of Niles Canyon. The Zone 7 Water Agency has included structures to assist fish passage in recent projects within Arroyo Las Positas and Arroyo Mocho.

LLNL also has done its share to restore and protect the Alameda Creek watershed. In 2004, LLNL removed a concrete low water crossing that had been used to access LLNL's Hetch Hetchy pumping station from Arroyo Mocho. The removal of the barrier will allow steelhead access to approximately eight miles of habitat in the upper reaches of Arroyo Mocho after other downstream barriers are removed. In 2005, LLNL completed a project to reduce erosion in the LLNL reach of Arroyo Seco by adding meanders to the channel, reducing the slope of the creek banks and revegetating the site with native plants. This project was designed to reduce the sediment input to the watershed from this site and improve wildlife habitat. LLNL also implements a storm water pollution prevention program to protect the quality of runoff discharged into Arroyo Seco and Arroyo Las Positas and has undertaken projects to protect and improve habitat and water quality in these two arroyos.

There are simple measures we can take in our daily lives to protect the water quality and habitat value of our watershed. At work, implement the Lab's storm water pollution prevention program and dispose of wastes properly. At home, join in local volunteer efforts to clean up and restore native plants to the creeks in your home town, make sure you dispose of chemicals such as oil, paint and solvents at appropriate facilities, use native and other drought tolerant plants in your yard, and visit your local creeks and learn more about these precious resources. In Livermore, there is easy access to local arroyos. The

Arroyo Mocho trail can be accessed from Robertson Park near Arroyo Road and the trail along Arroyo Valle is found in Sycamore Grove Regional Park off of Wetmore Road.

More information on the Alameda Creek watershed is available at <http://www.alamedacreek.org/>, and information on watersheds throughout the county can be found at <http://cfpub.epa.gov/surf/locate/index.cfm>.



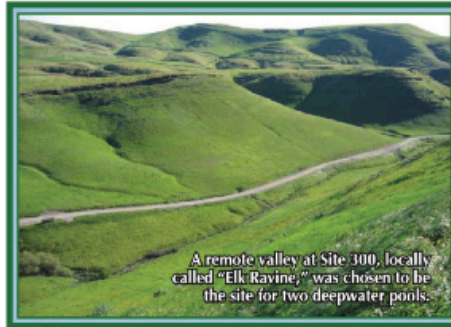
Newsline
UC-LLNL

PO Box 808, L-797
Livermore, CA 94551-0808

The Enhancement of a Site 300 Wetland

Photos and text by Jim Woollett

Revitalization of wetland areas has become an international concern. Wetland types such as marshes, estuaries, floodplains and shallow lakes provide functions of great value to society. Essential biological services of wetlands include water filtration and purification, flood control and maintenance of biodiversity. Current wetland deterioration and increased vulnerability are largely products of human intrusion; Site 300 recently enhanced a small, spring-fed streamcourse to increase wetland values on site.



A remote valley at Site 300, locally called "Elk Ravine," was chosen to be the site for two deepwater pools.



In late summer, accumulated sediments were removed and incised channels were enlarged and smoothed for the pool design.



Pools were crafted or "keyed" with 1- to 2-ton boulders to withstand the test of time and water, including the 100-year flood event.



After the wetland features were in place, biodegradable coconut fiber rolls were placed in the channel to help direct the water flow and minimize sedimentation downstream.



The area was seeded with native plants that would grow after the first winter rainstorms. Complete revitalization of this portion of Elk Ravine is expected within 5 to 10 years.

Vernal pools reflect seasonal changes

The new year is a time of renewal when we take a moment to reflect on our lives and make resolutions to change our ways. In California, the new year is also a time of renewal in nature. Nothing better exemplifies this than the rebirth of vernal pools in the rolling grasslands in the Tri-Valley and Central Valley. Not many people notice temporary wetlands, but these little oases play an extremely important role in Californian grasslands, providing water, habitat and food for many wildlife species.

Vernal pools are a type of temporary wetland that was once common but now is quite rare due to large-scale alteration of lands for agriculture and development. 'Vernal' means spring in Latin, and vernal pools are so named because of the amazing growth of flowers along the drying edge of the pools in the spring.

Despite the name, winter marks the actual beginning of the life cycle of vernal pools, as winter rains fill depressions. During the winter, vernal pools may look like nothing more than a big puddle, but they are already teaming with life. Both the California red-legged frog and California tiger salamander use temporary wetlands to breed in the early spring. In addition to our amphibian friends, there is a cornucopia of wildlife species waiting to "spring to life" when the vernal pools begin to fill with water.

Among these are the vernal pool tadpole shrimp and fairy shrimps (which resemble "sea monkeys" or the brine shrimp you had as a kid). These shrimp survive the dry phase of the pool



By Jennifer Garrison

sealed into tiny living time capsules called 'cysts' (which are really shrimp eggs with a special coating). The cysts hatch when they are submersed in water, and the baby shrimp grow to maturity in a few weeks to two months. The mature shrimps mate and produce new cysts, which can remain dormant for years. Because their unique habitats have become so rare, vernal pool tadpole shrimp and several species of

fairy shrimp are classified as federally endangered under the Endangered Species Act. Other common residents of vernal pools include beetle and dragonfly larvae, western spadefoot toads, and pacific tree frogs. Bobcats, coyotes, badgers, herons and egrets also visit the pools to drink water and to snack on the tasty critters living there.

As the pools dry and the animals depart, flowers bloom in concentric rings around the pool. Colors range from white to bright yellow to hot pink and purple. These vernal pool plants, many of which are found nowhere else in the world, have wonderful descriptive names, such as palmate-bracted bird's beak, little mousetail, calicoflower, monkey flower, and woolly marbles. All vernal pool plants are short-lived, and grow, flower, and put out seed while there is still moisture around the pool. The seeds will then wait patiently for the rains to begin, to start the whole process again.

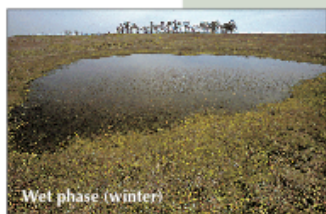
By the time the vernal pool has completely dried up in the summer, there is little sign to the casual observer of the plethora of life found there only a few months prior. The moral of the story is that sometimes first impressions can be deceiving — something that appears to be a plain brown field in the heat of summer can transform into something very special in the winter and spring. This winter see if you can find a vernal pool. Then remember where it is, go back to visit it as the seasons progress, and see what changes time brings.

Jennifer Garrison is an ecologist and wildlife biologist in EPD.

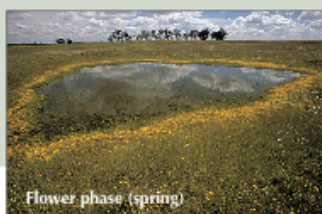


PHOTO © 1981 DR. GREN D. POLLAK

A typical vernal pool in the spring. Notice plant species change as you move away from the wetter center. The purple in the center of the photo is not water; it comes from thousands of purple flowers.



Wet phase (winter)



Flower phase (spring)



Dry phase (summer)

PHOTOS BY DAVID ROSEN, WILDSIDE PHOTOGRAPHY; PROVIDED BY SACRAMENTO SPLASH

The three phases of the vernal pool life cycle. There are many vernal pools in the Livermore Area, especially in North Livermore in the Springtown area.

Delving beneath the surface of the Laboratory's 'lake'

Those who wander near the Central Cafeteria may happen upon a small "lake" officially called the Drainage Retention Basin. An unspectacular body of water, it's clear that this basin is not entirely natural. It accumulates and retains water, yet water cannot percolate into the soil beneath it; thick polymer liner lies under a foot or more of basin sediment to prevent any natural passage. The basin perimeter is mainly grouted "rip rap," — an engineered buffer — rather than a natural mosaic of riparian vegetation. Tributaries into the basin mainly consist of hoses from groundwater treatment units or concrete, manmade storm channels rather than meandering streams flowing over pebbles.

Yet, in this arid valley, an oasis of water no matter how simple or small creates quite the stir. If you have water, many will come; wildlife, plants and people. And in such stark environs, a basin constructed in 1991 for specific purposes (i.e., temporary detention of surface water flows during the wet season of up to 37 million gallons, support for the cleanup efforts of contaminated groundwater beneath the LLNL site and flood control) will have objectives that evolve over time. The basin still serves the purposes for which it was designed, yet it attracts others. Wildlife and plants established themselves in the basin, creating wetland habitats. These habitats, in turn, enhance the attractiveness of the basin.

In the midst of our urban environment, muskrats make their home within the basin from time-to-time, taking languid swims. Dawn or dusk affords glimpses of a handful of different birds (e.g., red-winged blackbirds, egrets, green herons, pied-billed grebes) that keep a vigilant eye on the shallows at the water's edge. Dragonflies with intricate designs (look close) and vibrant colors dip into the water's surface and dart through edge

LLNL's wild side
By Jessie Coty



Top: Construction of the Drainage Retention Basin in 1991. The basin liner placement prevents the infiltration of water into the subsurface to facilitate efforts to treat and clean the groundwater beneath the LLNL site.

Bottom: The construction site of the new Terascale Facility overlooks the Drainage Retention Basin; note the grouted "rip rap" perimeter of the basin, which makes plant growth difficult.



Center: The bullfrog is a non-native, invasive frog that also inhabits the basin, yet threatens the survival of the native and federally threatened California red-legged frog.

Bottom right: The federally threatened California red-legged frog is known to inhabit the basin.

vegetation.

The LLNL community walks, runs, bikes, watches birds and other wildlife, or sits conversing near and around the basin. Protecting the basin is important (it helps meet environmental regulations) and difficult.

Game fish adversely impact the area's native California red-legged frogs, which are threatened with extinction and also inhabit the basin. Any

non-native species also disrupt the natural dynamics of the basin's ecosystem, which is a simple aquatic system compared to natural lakes, such as Lake Tahoe, and unable to easily adapt to changes.

Freestyle swimming laps across the breadth of the basin? In the rainy season, this four-acre basin collects water from approximately a quarter of the LLNL site and 700-900 acres of off-site horse and cattle ranchland.

This overland flow is not the relatively pristine water that gallops from a river's headwaters in Montana, but rather is a surface flow from an industrial, municipal, and agricultural area — not an ideal spot for swimming.

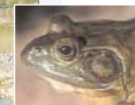
Use the basin as an alternative home for those pets or plants no longer wanted, such as goldfish or an abandoned

aquarium's vegetation? These creatures actually degrade the health of both species and the basin's ecosystem.

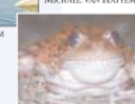
Not only is it ecologically detrimental to have non-native, invasive species introduced within the basin, these



Top right: The intricately designed wings and vibrantly colored body of dragonflies are easily seen at the basin.



Center: The bullfrog is a non-native, invasive frog that also inhabits the basin, yet threatens the survival of the native and federally threatened California red-legged frog.



further endanger the survival of the few native species already established. Finally, it is against federal and state laws to engage in acts that harm the California red-legged frog. This means the simple act of placing your favorite non-native frog (e.g., bull frog) or game fish into the basin might be well-intentioned, but it's illegal.

So in this hot and arid environment, an artificially constructed basin becomes a natural and attractive facet of the LLNL site.

Got water? They'll come.

Lab blood drive honored



Jacqueline McBride/Newsline

LLNL retirees Barbara Hill and Ben Mendoza, center, show the awards recently presented to the Lab by Red Cross Northern California Blood Services. Joining them were (left to right) Joni Schuld, Ron Hill, Jan Tulk, Fred Kloverstrom and Glenn Mara. The Lab was honored again this year as the top sponsoring organization for the Northern California region. In addition, LLNL retirees were honored as one of the top Red Cross blood drive volunteer groups.



Newsline
UC-LLNL
PO Box 808, L-797
Livermore, CA 94551-0808

Going wild over turkeys is a November tradition

As Thanksgiving approaches, it seems fitting to contemplate the wild turkey as the national symbol that it nearly became. Just after signing the Declaration of Independence, the Continental Congress appointed a three-member committee to design a national seal. Thomas Jefferson, John Adams and Benjamin Franklin all had different ideas; none included the bald eagle. Franklin wanted the wild turkey as the national bird and was disappointed by the decision made in 1782 to use the bald eagle, as he felt that the bald eagle was of "bad moral character." Despite this choice to overlook the wild turkey, it still runs high in our national attention every November.

A "down-to-earth" sort of bird

Anyone that walks, runs, or cycles the roads surrounding the Laboratory may be familiar with a heavily feathered rush of round-bellied birds flying suddenly and low across the road. With this low flight display, it's not a surprise that the wild turkey (*Meleagris gallopavo*) belongs to the order Galliformes (ground-nesting fowl). Except for roosting, it spends its time on the ground. Although the turkey doesn't fly often nor far, it reaches flying speeds of 45-50 mph; it also has a respectable 15-mph running speed.

The wild turkey is a highly gregarious flocking bird; it's not a rare experience to see a large group of turkeys standing together in a field or along the roadside. Breeding behavior is triggered with lengthening daylight in winter; males (toms or gobblers) gobble and display for females (hens). The hens lay an egg a day until reaching a clutch size of 10-12 eggs. Incubation is about 28 days and precocial poults quickly learn survival skills by imprinting on their mother and learning her behaviors. They fly and roost in trees by two weeks, reach adult size by three to four months and achieve sexual maturity by one year.

Wild turkeys look for two key components in their habitat: trees and open grasslands. The trees provide food, nighttime roost sites and cover; grasslands provide well-covered forage and nesting areas. Wild turkeys are omnivores and they consume a wide variety of plants (including agricultural crops) and animals (largely invertebrates).



LLOYD INGLES
©CALIFORNIA ACADEMY OF SCIENCES



2004 TOM GREER

Left: Wild turkeys investigating a new habitat, parking lots. Above: A displaying wild turkey (*Meleagris gallopavo*).

Another Californian not from California

Although the wild turkey is native to North America and occurs widely across the United States, it was not present in California at the time of European settlement. Like many of us, the wild turkey is yet another transplant (non-native). To complicate matters, wild turkeys are comprised of six subspecies, of which California is now home to three: the Rio Grande, Merriam's, and eastern turkeys. A "California Hybrid" also occurs, a result of subspecies interbreeding.

The first known introduction of a wild turkey to California occurred in 1877 by private ranchers on Santa Cruz Island. Beginning in 1908, the California Department of Fish and Game (CDFG) purposefully released turkeys to establish populations across the state. A breeding stock was used for periodic releases; these

domesticated birds lacked the survival and reproduction skills necessary for the wild. In 1951, the CDFG moved to a program of wild turkey releases (capture and translocation of wild birds), which proved successful at establishing sustainable populations. It released nearly 3,000 and 950 turkeys between 1959-1988 and 1989-1999, respectively. Estimates show that the birds now occupy approximately 29,000 square miles (18.5 percent) of the state with a density of 8.3 turkeys per square mile (approximately 242,000 wild turkeys).

Popular game species or unpopular nonnative nuisance?

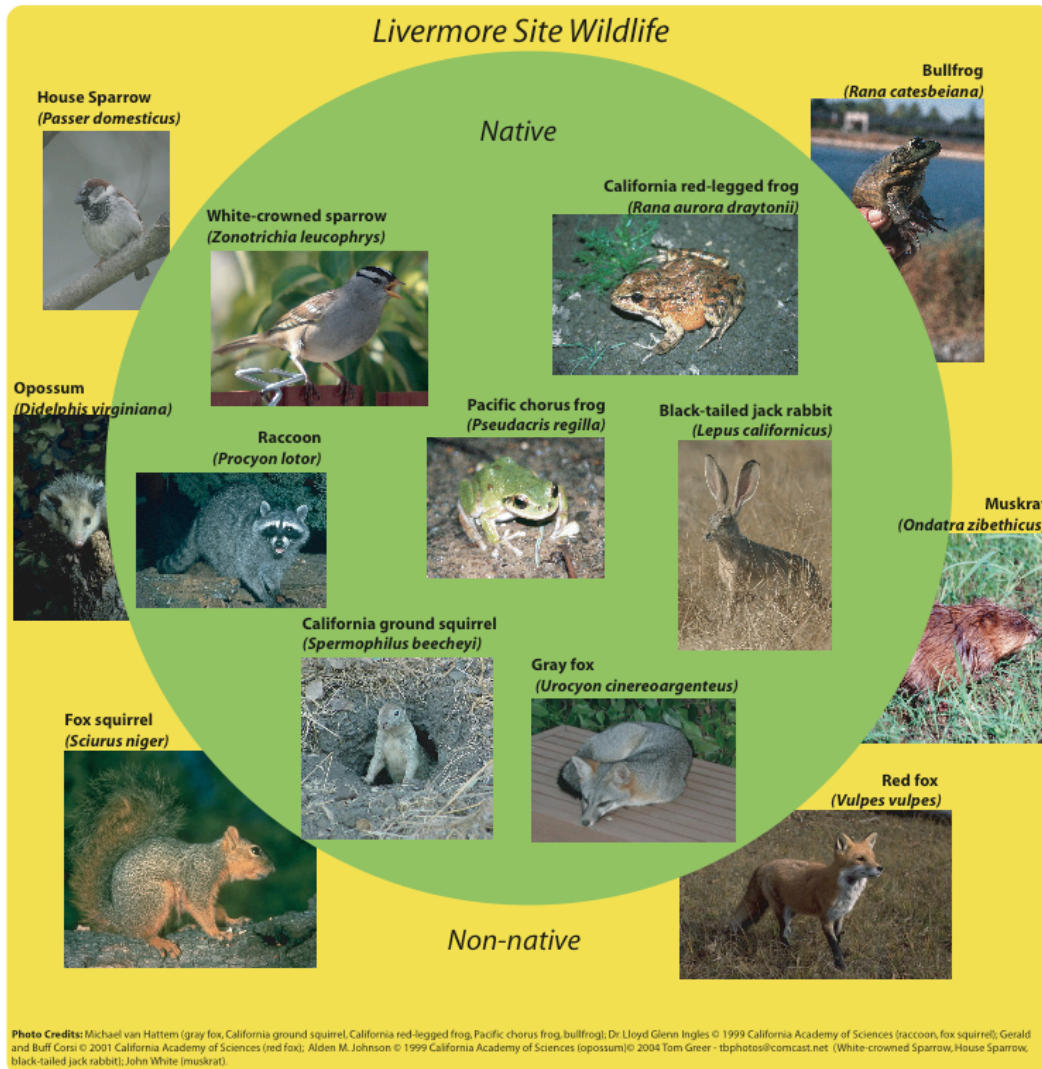
The wild turkey is the largest game bird in the state. Maintaining this species for hunters and wildlife viewing is an important objective for the CDFG; sport hunting for wild turkey is popular and highly valued.

Historically, the first open season for hunting wild turkey occurred in 1968 (one county). As turkeys became more abundant, hunting season opened across remaining counties. By 1979, two-season (fall and spring) hunting occurred across the state. However, spring season hunting is considered more biologically sustainable for wild turkey populations. A harvest of up to 30 percent of males in spring is not considered to effect turkey population growth, yet harvesting more than 10 percent of the fall population often results in population declines (due to harvesting females). As a result, California changed its hunting regulations in 1998, to encourage spring hunting. By careful management of the spring and fall hunting seasons, the CDFG can ensure sustainable populations across California, without requiring further releases.

Yet, the distribution of turkeys varies quite a bit across the state. High densities of turkeys can have negative impacts in residential, agricultural and park lands. The turkey, once nominated for status as our national bird, is often considered a nuisance; it damages gardens and landscaping, defecates in public areas, exhibits aggressive behavior and incurs agricultural depredation. It eats wine grapes, although video cameras prove other species also are to blame. Finally, parks have a mandate to promote and protect native species; conflicts therefore arise with nonnative turkeys.

The wild turkey presents a common conundrum for environmental agencies who must balance their efforts to ensure sustainable populations of species for recreational purposes while minimizing their detrimental effects. For wild turkey management, this means reducing populations in problematic areas while enhancing populations in other areas. You can help this management effort by not feeding turkeys, not releasing domestic turkeys and by celebrating the turkey on Thanksgiving as "national bird" for the day.

Livermore Site Wildlife: The wildlife found at LLNL's Livermore site today includes a core of remnant native grassland and riparian species in addition to exotic species introduced to the area through human influence. In spring, these animals become more active, and interactions between wildlife and people become more common. Wildlife is not restricted by the boundaries of this site, and our actions at this site influence not only the wildlife here but also the grassland and riparian ecosystems beyond the site boundaries. Please follow the simple guidelines listed below to insure the Livermore site wildlife does not become a nuisance to the human inhabitants of the site, and that we reduce our impacts to the wildlife here and in the surrounding ecosystems. For more information on Livermore site wildlife, visit the walking tour around the Haussmann Lake (Drainage Retention Basin) near the Central Cafeteria.



Livermore site wildlife guidelines: 1) Only observe wildlife from a distance; 2) Feeding wild animals causes them to be unnaturally accustomed to interactions with people and can lead to aggressive behavior, never feed wild animals or leave food where it can be accessed by wild animals; 3) Introducing exotic or domestic species to any environment can have serious consequences. Captive wildlife or pets should not be released or relocated.